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THE

PHILOSOPHY

OF

NATURAL HISTORY.

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MVSEVM
BRITAN
NICVM

TO

HIS ROYAL HIGHNESS

GEORGE

PRINCE OF WALES,

THE PHILOSOPHY OF NATURAL HISTORY

IS MOST HUMBLY DEDICATED,

BY HIS DEVOTED SERVANT

WILLIAM SMELLIE.

PREFACE.

EVERY Preface, beſide occaſional or explanatory remarks, ſhould contain not only the general deſign of the work, but the motives and circumſtances which induced the author to write upon that particular ſubject. If this plan had been univerſally obſerved, prefaces would have exhibited a ſhort, but a curious and uſeful, hiſtory both of literature and of authors. Influenced by this idea, I ſhall give a very compendious account of the origin, deſign, and progreſs of the following work.

About fifteen years ago, in a converſation with the late worthy, reſpectable, and ingenious LORD KAMES, upon the too general neglect of natural knowledge, his Lordſhip ſuggeſted the idea of compoſing a book on the PHILOSOPHY OF NATURAL HISTORY. In a work of this kind, he propoſed that the productions of Nature, which to us are almoſt infinite, ſhould, inſtead of being treated of individually, be arranged under general heads; that, in each of theſe diviſions, the known facts, as well as reaſonings, ſhould be collected and methodiſed in the form of regular diſcourſes; that as few technical terms as poſſible ſhould be employed; and that all the uſeful and amuſing views ariſing from the different ſubjects ſhould be exhibited in ſuch a manner as to convey both pleaſure and information.

This taſk his Lordſhip was pleaſed to think me not altogether unqualified to attempt. The idea ſtruck me. I thought that a work of this kind, if executed even with moderate abilities, might excite a taſte for examining the various objects which every where ſolicit our attention. A habit of obſervation refines our feelings. It is a ſource of intereſting amuſement, prevents idle or vicious propenſities, and exalts the mind to a love of virtue and of rational entertainment. I likewiſe reflected, that men of learning often betray an ignorance on the moſt common ſubjects of Natural Hiſtory, which it is painful to remark.

I have been occaſionally employed, ſince the period which I have mentioned, in collecting and digeſting materials from the moſt authentic ſources. Theſe materials I have interſperſed with ſuch obſervations, reflections, and reaſonings, as occurred to me from conſidering the multifarious ſubjects of which I have ventured to treat. I knew that a deliberate peruſal of the numerous writers from Ariſtotle downwards, would require a conſiderable portion of time. But the avocations of buſineſs, and the tranſlating of a work ſo voluminous as the *Natural Hiſtory of the* COUNT DE BUFFON, rendered my progreſs much ſlower than I wiſhed. I now, however, with much diffidence, ſubmit my labours to public opinion. An examination of the *Contents*, however, will convey a more clear idea of the nature of the work than a multiplicity of words. But I thought it proper to prefix a ſhort account of the circumſtances and motives which induced me to engage in an undertaking ſo extenſive, and ſo difficult to perform with tolerable ſucceſs.

With regard to the manner of writing, it is perhaps impoſſible for a North Briton, in a work of any extent, to avoid what are called *Scotticiſms*. But I have endeavoured to be every where perſpicuous, and to ſhun every ſentiment or expreſſion which might have a tendency to injure ſociety, or to hurt the feelings of individuals.

Indulgent readers, though they muſt perceive errors and imperfections, will naturally make ſome allowance for the variety of reſearch, and the labour of condenſing ſo much matter into ſo ſmall a compaſs. He is a bad author, it has been ſaid, who affords neither an aphoriſm nor a motto.

I cannot refrain from mentioning a circumſtance which has often made me uneaſy. The expectations of ſome friends were higher than I was conſcious my abilities could reach.

Upon the whole, the general deſign of this publication is, to convey to the minds of youth, and of ſuch as may have paid little attention to the ſtudy of Nature, a ſpecies of knowledge which it is not difficult to acquire. This knowledge will be a perpetual and inexhauſtible ſource of manly pleaſures; it will afford innocent and virtuous amuſement, and will occupy agreeably the leiſure or vacant hours of life.

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ERRATA.

Page 286. *line* 6. *dele* their.

Page 383. *line* 6. from the bottom, *for* ſpeeders *read* ſpiders.

THE PHILOSOPHY OF NATURAL HISTORY.

CHAPTER I.

Diſtinguiſhing characters of Animals, Plants, and Minerals—The Analogies between the plant and animal, ariſing from their ſtructure and organs, their growth and nouriſhment, their diſſemination and decay.

NATURAL Bodies, when viewed as they have a relation to man, are marked with characters ſo apparent, that they eſcape not the obſervation of the moſt unenlightened minds. In a ſyſtem where all the conſtituent parts have a reciprocal dependence, and are connected by relations ſo ſubtile as to elude the perception of animals, ſuch obvious characters were indiſpenſible. Without them, neither the affairs of human life, nor the functions of the brute creation, could be carried on. Characters of this kind are accommodated to the apprehenſion of brutes and of vulgar men.

But, when the productions of nature are more cloſely examined; when they are ſcrutinized by the eye of philoſophy, the number of their relations and differences is diſcovered to be almoſt infinite; and their ſhades of diſcrimination are often ſo delicate, that no ſenſe can perceive them. Nothing, apparently, is more eaſy than to diſtinguiſh an animal from a plant; and yet the proper diſtinction has puzzled the moſt acute inquirers, and perhaps exceeds the limits of human capacity.

'A plant,' ſays Jungius, 'is a *living*, but not a *ſentient* body, 'which is fixed in a determined place, and grows, increaſes 'in ſize, and propagates its ſpecies[*].' In this definition living powers are aſcribed to vegetables; but they are denied the faculty of ſenſation. Life, without ſome degree of ſenſation, is an incomprehenſible idea. An animal limited to the ſenſe of feeling alone, is the loweſt conception we can form of life. Deprive this being of the only ſenſe it poſſeſſes, and, though its figure ſhould remain, we would inſtantly conclude it to be as inanimate as a ſtone. The life attributed to plants ſeems to be nothing more than an analogical deduction from their growth, nutrition, continuation of their ſpecies, and ſimilar circumſtances.

Ludwig defines vegetables to be 'Natural bodies, always endowed with the ſame form, but deprived of the power of local 'motion[†].' Every branch of this definition is, with equal propriety, applicable to precious ſtones, ſalts, and ſome animals; and, therefore, requires no farther attention.

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[*] Raii Hiſt. Plant. p. 1.

[†] Ludwig, Phil. Bot. p. 1.

Sir Charles Linnaeus, in his Fundamenta Botanica, intends to diſcriminate the three kingdoms of Nature in two lines. 'Stones,' ſays he, '*grow*; vegetables grow and *live*; animals grow, live, 'and *feel*[*].' This is an aſſemblage of words, the meaning of which is entirely perverted. The idea of growth implies nutrition and expanſion by the intervention of organs. The magnitude of ſtones may be augmented by an accretion of new matter. But this is not growth, or expanſion of parts. The ſecond definition, 'That vegetables grow and *live*,' is equally inaccurate. Inſtead of proving the life of plants, Linnaeus takes it for granted, and makes it the characteriſtic between vegetables and brute matter. The third, 'That animals grow, live, and *feel*,' is not leſs exceptionable. Growth, life, and mere ſenſation, convey the moſt ignoble notions of animated beings. From this definition, we would be led to imagine, that Linnaeus meant to deſcribe the condition of a polypus or an oyſter. All animals, it is true, grow, live, and feel: But theſe are only the paſſive properties of animals. The definition includes none of thoſe inſtinctive, intellectual, and active powers which exalt the animal above the vegetable, and ſo eminently diſtinguiſh the different tribes from each other.

Theſe and many other abortive attempts have been made to aſcertain the preciſe boundaries between the animal and vegetable. Definitions have been the perpetual aim of moſt writers on this ſubject. But definitions, when applied to natural objects, muſt always be vague and eluſory. We know not the principle of animal life. We are equally ignorant of the eſſential cauſe of vegetable exiſtence. It is vain, therefore, to dream of being able to define what we never can know. We may, however, diſcover ſome qualities common to the animal as well as to the vegetable.

Senſation,

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[*] Fund. Bot. § 3.

Senſation, motion, and ſtructure of parts, give animals a more extenſive range in their connection with external objects. A certain portion of intellect, joined to the vital principle, ſeem to be the moſt diſtinguiſhing properties of animals, and to conſtitute their eſſence or being. Animals will, determine, act, and have a communication with diſtant objects by their ſenſes. They have the laws of nature, in ſome meaſure, at command. They protect themſelves from injury by employing force, ſwiftneſs, addreſs, and cunning. But vegetables remain fixed in the ſame place, and are ſubject to every thing that moves. Animals eat at intervals; their food requires time for digeſtion, and to anſwer the complicated purpoſes of ſecretion and nutrition. The ſtructure of plants is more ſimple: They receive perpetual nouriſhment without injury. Animals ſearch for and ſelect particular kinds of food. But plants muſt receive whatever is brought to them by the different elements. Animals exiſt on the ſurface and in the interior parts of the earth, in the air, in water, in the bodies of men and other animals, in the internal parts of plants, and even in ſtones. But, if we except a few aquatics, plants are fixed to the earth by roots.

All animals, it has been affirmed, have a heart, or particular fountain for propelling and diſtributing their fluids to the different parts of their bodies: But caterpillars, and many other inſects, have no ſuch general receptacle.

The loco-motive faculty has been conſidered as peculiar to animals. But even this character is extremely ſuſpicious. Oyſters, ſea-nettles, the gall-inſects, and a variety of other animals, can hardly be ſaid to enjoy the power of local motion. Many ſpecies remain for ever fixed to the rocks on which they are produced, and have no motion but that of extending or contracting their bodies. Beſides, examples of different kinds of motion are diſcoverable in the vegetable kingdom. When the roots of a tree meet with a ſtone, or any other obſtruction to their motion, in order to avoid it, they change their former direction. They turn from barren to fertile earth, which indicates ſomething analogous to a ſelection of food. Like the polypus, plants, when confined in a houſe, uniformly bend toward the window or aperture through which the rays of light are introduced.

The ſenſitive plant poſſeſſes the faculty of motion in an eminent degree. The ſlighteſt touch makes its leaves ſuddenly ſhrink, and, together with the branch, bend down toward the earth. But the moving plant, or hedyſarum movens, of which there are ſpecimens in the botanic garden of Edinburgh, furniſhes the moſt aſtoniſhing example of vegetable motion. It is a native of the Eaſt Indies. Its movements are not excited by the contact of external bodies, but ſolely by the influence of the ſun's rays. The motions of this plant are confined to the leaves, which are ſupported by long flexible footſtalks. When the ſun ſhines, the leaves move briſkly in every direction. Their general motion, however, is upward and downward: But they not unfrequently turn almoſt round; and then their footſtalks are evidently twiſted. Theſe motions go on inceſſantly as long as the heat of the ſun continues: But they ceaſe during the night, and when the weather is cold and cloudy. Our wonder is excited by the rapidity and conſtancy of the movements peculiar to this plant. The frequency, however, of ſimilar motions in other plants, renders it probable that the leaves of all vegetables move, or are agitated by the rays of the ſun, though many of theſe movements are too ſlow for our perception.

The American plant called *dionaea muſcipula*, or *Venus's fly-trap*, affords another inſtance of rapid vegetable motion. Its leaves are jointed, and furniſhed with two rows of ſtrong prickles. Their ſurfaces are covered with a number of minute glands, which ſecrete a ſweet liquor, and allure the approach of flies. When theſe parts are touched by the legs of a fly, the two lobes of the leaf inſtantly riſe up, the rows of prickles lock themſelves faſt together, and ſqueeze the unwary animal to death. If a ſtraw or a pin be introduced between the lobes, the ſame motions are excited.

When a ſeed is ſown in a reverſed poſition, the young root turns downward to enter the earth, and the ſtem bends upward into the air. Confine a young ſtem to an inclined poſition, and its extremity will ſoon aſſume its former perpendicular direction. Twiſt the branches of any tree in ſuch a manner that the inferior ſurfaces of the leaves are turned toward the ſky, and you will, in a ſhort time, perceive that all theſe leaves reſume their original poſition. Theſe motions are performed ſooner or later, in proportion to the degree of heat, and the flexibility of the leaves. Many leaves, as thoſe of the mallow, follow the courſe of the ſun. In the morning, their ſuperior ſurfaces are preſented to the eaſt; at noon, they regard the ſouth; and, when the ſun ſets, they are directed to the weſt. During the night, or in rainy weather, theſe leaves are horizontal; and their inferior ſurfaces are turned toward the earth.

What has been denominated the Sleep of Plants, affords an inſtance of another ſpecies of vegetable motion. The leaves of many plants fold up during the night; but, at the approach of the ſun, they expand with renewed vigour. The common appearances of moſt vegetables are ſo changed in the night, that it is difficult to recogniſe the different kinds, even by the aſſiſtance of light.

The modes of folding in the leaves, or of ſleeping, are extremely various. But it is worthy of remark, that they all diſpoſe themſelves

ſelves ſo as to give the beſt protection to the young ſtems, flowers, buds, or fruit. The leaves of the tamarind-tree contract round the tender fruit, and protect it from the nocturnal cold. The caſſia or ſenna, the glycine, and many of the papilionaceous plants, contract their leaves in a ſimilar manner. The leaves of the chickweed, of the aſclepias, atriplex, &c. are diſpoſed in oppoſite pairs. During the night, they riſe perpendicularly, and join ſo cloſe at the top, that they conceal the flowers. The leaves of the ſida or althaea Theophraſti, of the ayenia, and oenothera, are placed alternately. Though horizonal, or even depending, during the day, at the approach of night they riſe, embrace the ſtem, and protect the tender flowers. The leaves of the ſolanum, or nightſhade, are horizontal during the day; but, in the night, they riſe and cover the flowers. The Egyptian vetch erects its leaves during the night, in ſuch a manner that each pair ſeem to be one leaf only. The leaves of the white lupine, in the ſtate of ſleep, hang down, and protect the young buds from being injured by the nocturnal air.

Theſe and ſimilar motions are not peculiar to the leaves of plants. The flowers have alſo the power of moving. During the night, many of them are incloſed in their calixes. Some flowers, as thoſe of the German ſpurge, geranium ſtriatum, and common whitlow graſs, when aſleep, hang their mouths toward the earth, to prevent the noxious effects of rain or dew.

The cauſe of thoſe movements which conſtitute the ſleep of plants, has been aſcribed to the preſence or abſence of the ſun's rays. In ſome of the examples I have given, the motions produced are evidently excited by heat. But plants kept in a hot-houſe, where an equal degree of heat is preſerved both day and night, fail not to contract their leaves, or to ſleep, in the ſame manner as when they are expoſed to the open air. This fact evinces, that the ſleep of plants is rather owing to a peculiar law, than to a quicker or ſlower motion of their juices.

A ſtomach and brain have been reckoned eſſential characteriſtics of the animal; and plants are ſaid to poſſeſs nothing analogous to theſe organs. But the polypus has no ſtomach; or rather, like vegetables, its whole body may be conſidered as a ſtomach. Its internal cavity contains no viſcera; and, when this animal is turned outſide in, it ſtill continues to live, and to digeſt its food, in the ſame manner as if it had received no injury. The mode by which plants are nouriſhed is extremely analogous. They imbibe food by the roots, the trunk, the branches, the leaves, and the flowers. Inſtead, therefore, of having no ſtomach, their whole ſtructure is ſtomach. With regard to the brain, the polypus, and many other inſects, are deprived of that organ. Hence neither ſtomach nor brain are eſſential characters which diſcriminate the animal from the vegetable.

But all animals are endowed with ſenſation, or at leaſt with irritability, which laſt has been conſidered as a diſtinctive character of animal life. Senſation implies a diſtinct perception of pleaſure and pain. We infer the exiſtence of ſenſation in organized bodies, when we perceive that they have organs ſimilar to our own, or when they act, in certain circumſtances, in the ſame manner as we act. If an organized being has eyes, ears, and a noſe, we naturally conclude that it enjoys the ſame ſenſations as theſe organs convey to us. If we ſee another being, whoſe ſtructure exhibits nothing analogous to our organs of ſenſation, contracting with rapidity when touched, directing its body uniformly to the light, ſeizing ſmall inſects with *tentacula*, or a kind of arms, and conveying them into an aperture placed at its anterior end, we heſitate not to pronounce that it is animated. Cut off its arms, deprive it of the faculty

culty of contracting and extending its body, the nature of this being will not be changed; but we will be unable to determine whether it poſſeſſes any portion of life. This is nearly the condition of the ſmall ſections of a polypus, before their heads begin to grow. The wheel-animal, the eels in blighted wheat, and the ſnails recorded in the Philoſophical Tranſactions, afford inſtances of every appearance of ſenſation, or even of irritability, being ſuſpended, not for months, but for ſeveral years, and yet the life of theſe animals is not extinguiſhed; for they uniformly revive upon a proper application of moiſture.

Theſe and ſimilar facts ſhow, that we are entirely ignorant of the eſſence and properties of life. What life really is, ſeems too ſubtile for our underſtanding to conceive, or our ſenſes to diſcern. If we have no other criterions to diſtinguiſh life, than motion, ſenſation, and irritability, the animals juſt mentioned continued for years in a ſtate which every man would pronounce to have been perfectly dead. It is poſſible, therefore, that life may exiſt in many bodies which are commonly thought to be as inanimate as ſtones. Hence it would be raſh to exclude plants from every ſpecies of ſenſation. The degrees of ſenſation decreaſe imperceptibly from man to the ſea-nettle, gall-inſects, and what are called the moſt imperfect animals. Every vegetable, as well as the ſenſitive plant, ſhrinks when wounded. But, in moſt of them, the motion is too ſlow for our perception. When trees grow near a ditch, the roots which proceed in a direction that would neceſſarily bring them into the open air, inſtead of continuing this noxious progreſs, ſink below the level of the ditch, then ſhoot acroſs, and regain the ſoil on the oppoſite ſide. When a root is uncovered, without expoſing it to much heat, and a wet ſpunge is placed near it, but in a different direction from that in which the root is proceeding, in a ſhort time the root turns towards the ſpunge. In this manner the direction of roots may be varied at pleaſure. All plants make the ſtrongeſt efforts, by inclining, turning, and even twiſting their ſtems and branches, to eſcape from darkneſs and ſhade, and to procure the influences of the ſun. Place a wet ſpunge under the leaves of a tree, they ſoon bend downward, and endeavour to apply their inferior ſurfaces to the ſpunge. If a veſſel of water be placed within ſix inches of a growing cucumber, in twenty-four hours the cucumber alters the direction of its branches, bends either to the right or left, and never ſtops till it comes into contact with the water. When a pole is placed at a conſiderable diſtance from an unſupported vine, the branches of which are proceeding in a contrary direction from that of the pole, in a ſhort time, it alters its courſe, and ſtops not till it clings around the pole.

Facts of this kind excite our wonder; but they by no means prove that vegetables live, or that they are endowed with ſenſation, which implies a diſtinct perception of pleaſure and pain.

There is an inferior ſpecies of ſenſation, which is diſtinguiſhed by the term *irritability*. This term denotes that power by which muſcular fibres, even after they are detached from the body, contract upon the application of any ſtimulating ſubſtance, whether ſolid or fluid. The heart of a frog, when pricked with the point of a pin, continues to beat, or to contract and dilate, for ſeveral hours after it has been cut out of the animal's body. The heart of a viper, or of a turtle, beats diſtinctly from twenty to thirty hours after the death of theſe animals. The periſtaltic motion of the inteſtines is produced by their irritability. When the inteſtines of a dog, or any other quadruped, are ſuddenly cut into different portions, all theſe portions crawl about like worms, and contract upon the ſlighteſt touch. Though irritability be unqueſtionably a vital principle, yet it is equally certain, that muſcular fibres, when ſeparated from the body to which they belong, have no diſtinct perception of pleaſure or pain. Their regular contraction and dilatation are evident ſymptoms of life, which, in many caſes, may lead us to attribute living powers to ſubſtances that enjoy neither life nor ſenſation. Hence, though all plants were irritable, this circumſtance would not prove that they are poſſeſſed of life. The contraction and dilatation of the ſenſitive plants, and the various motions of the leaves, branches, flowers, and roots of vegetables formerly mentioned, ſeem to indicate that moſt plants are endowed with irritability. Perhaps all vegetables have more or leſs of this quality. The heart, inteſtines, and diaphragm, are the moſt irritable parts of animal bodies: And, to diſcover whether this quality reſides in all plants, experiments ſhould be made chiefly on their leaves, flowers, buds, and the tender fibres of the roots.

From this narration of facts, it appears, that plants make a very near approach to animals; and that this ſimilarity, as well as the difficulty of fixing the preciſe boundaries by which theſe two great kingdoms of nature are limited, are direct conſequences of the organization of vegetables. It is owing to their organic ſtructure alone, that plants and animals are capable of affording reciprocal nouriſhment to each other. This organic ſtructure, though greatly diverſified in the different ſpecies of animals and vegetables, evinces that Nature, in the formation of both, has acted upon the ſame general plan. May we not preſume, therefore, as plants as well as animals are compoſed of a regular ſyſtem of organs, that the vegetable part of the creation is not entirely deprived of every quality which we are apt to think peculiar to animated beings? I mean not to inſinuate, that plants can perceive pleaſure or pain. But, as many of their motions and affections cannot be explained upon any principle of mechaniſm, I am inclined to think, that they originate from the power of irritability, which, though it implies not the perception of pleaſure and pain, is the principle that regulates all the vital or involuntary motions of animals. To aſcertain this point, would require a ſet of very nice experiments. I ſhall mention one, which might be performed with tolerable eaſe. It was formerly remarked, that plants kept in a hot-houſe, where the degree of heat is uniform, never fail to ſleep during the night. This is direct evidence, that heat alone is not the cauſe of their vigilance. But they are deprived of light. Let, therefore, a ſtrong artificial light, without increaſing the heat, be thrown upon them. If, notwithſtanding this light, the plants are not rouſed, but continue to ſleep as uſual, then it may be preſumed that their organs, like thoſe of animals, are not only irritable, but require the reparation of ſome invigorating influence which they have loſt while awake, by the agitations of the air and the ſun's rays, by the act of growing, or by ſome other latent cauſe.

It is almoſt unneceſſary to mark the diſtinction between vegetables and minerals. The tranſition from the animal to the plant is effected by ſhades ſo imperceptible, as to elude the moſt acute obſervers. But, between the plant and the mineral, there is a vaſt chaſm in the chain of being, which may be the ſource of great diſcoveries. In bodies purely mineral, not a veſtige of organization can be diſcovered. The fibrous ſtructure of the aſbeſtos has been regarded as an approach toward organization, and as the link which connects the mineral to the vegetable kingdom. But this is one of thoſe ſtrained analogies which are too often employed by theoretical writers. Though the aſbeſtos is compoſed of a kind of threads or fibres, theſe fibres are not tubular; neither are they interwoven, like that regular tiſſue or fabric which ſo remarkably diſtinguiſhes organized from brute matter. Of courſe, the magnitude of the aſbeſtos can only be increaſed by the appoſition of new matter, and not by any developement or expanſion of parts. But though, in the mineral kingdom, Nature ceaſes to organize, ſhe continues to arrange.

The regular configuration of ſalts, cryſtals, and other precious ſtones, has been conſidered by ſome authors as the reſult of an organic proceſs. But the uniform figure of ſalts and chryſtals may be the effect of certain laws of attraction peculiar to each ſpecies. None of theſe particles can be regarded as a germ or bud. They are only the elements or conſtituent parts, which, when applied to each other, form a whole. They never expand or grow, like the embrios of animals or plants. They remain for ever in the ſame ſtate without diminution or increaſe, except when ſeparated by force, or magnified by an accumulation of freſh matter. The chryſtalline juice is not aſſimulated by veſſels: It is prepared by a chymical operation of Nature. The bodies of plants and animals are machines, exceedingly elaborate, and more or leſs complicated. Theſe machines, by means of different organs, have the power of converting other animals and vegetables into their own ſubſtance. By this aſſimulation, all their dimenſions are increaſed; and their various parts uniformly preſerve the ſame proportions with regard to each other, and continue to perform their reſpective functions. Beſides, organized bodies not only multiply their ſpecies, but ſome of them poſſeſs the power of reproducing ſuch parts as are forcibly abſtracted from them.

In theſe and many other qualities common to the animal and vegetable, there is not the ſmalleſt analogy to be found in the mineral kingdom. Between the moſt regular foſſils, as ſalts and chryſtals, and the moſt imperfect animal or vegetable, the diſtance is immenſe. Figured foſſils are not more organized than a column or a portico. In the formation of the former, Nature, in that of the latter, man, is the artiſt. When no ſimilarity is to be diſcovered in thoſe foſſils which are nearly uniform in their configuration, we are not to expect it in the more looſe and irregular parts of brute matter. Here, Nature, regardleſs of ſymmetry, conjoins heterogeneous materials, of which ſhe compoſes irregular maſſes. Many ſtones, flints, and other concretions, afford examples of this kind. More art, it muſt be acknowledged, appears in the formation of metals: But their ſtructure exhibits no veſtiges of organization.

ANALOGIES.

HAVING ſhown the extreme difficulty of fixing the boundaries which ſeparate the animal from the vegetable kingdom, I proceed to the more pleaſing taſk of enumerating ſome of thoſe beautiful analogies which ſubſiſt between them. To render this ſubject the more agreeable and inſtructive, inſtead of bringing together an unconnected maſs, I ſhall trace the analogies between the animal and plant, under the arrangement of *Structure and Organs*, *Growth and Nouriſhment*, *Diſſemination and Decay*.

STRUCTURE AND ORGANS.

IN all organized bodies, a ſimilarity of ſtructure ſeems to be unavoidable. The bodies of men and quadrupeds conſiſt of a ſeries of connected bones, which run from the head to the rump. This ſeries is known by the name of the *back-bone*, from each ſide of which, a number of arched bones proceed. Some of theſe join the breaſt-bone by means of cartilages, and form a vaulted cavity, which contains and defends the heart, and other viſcera proper to the cheſt.

The bones of the pelvis, and of the four extremities, are joined to the back-bones by articulations and membranes. By the ſame contrivance, the cranium is fixed to the upper end of the back-bones. Into different proceſſes and portions of all theſe bones, a great number of muſcles, or bundles of fleſhy fibres, are inſerted. Theſe muſcles are the inſtruments which give riſe to all the varieties of animal motion. The bones of the head, or cranium, contain the brain and cerebellum, a prolongation of which runs through the whole extent of the canal in the back-bone, and is known by the term *ſpinal marrow*. From the brain and ſpinal marrow proceed all the nerves, or inſtruments of ſenſation. Theſe nerves, the ramifications of which are infinitely various and minute, are diſtributed upon the heart, lungs, blood-veſſels, bowels, and muſcles, till they terminate on the ſkin, or external covering of the body. The heart is the fountain, or general receptacle of the blood. The contraction of the heart propels the blood through the arteries, which are likewiſe diſtributed, by numerous and complicated ramifications, over every part of the body, and terminate in the veins, which again collect the whole arterial blood into one cavity, and reconvey it to the heart. This circulatory proceſs goes on during life.

Beſide the organs already mentioned, there are others, termed *ſecretory*, becauſe they ſeparate peculiar fluids from the general maſs of circulating blood. The ſtomach and inteſtines are furniſhed with a vaſt number of ſmall tubes, called *lacteal ducts*, which ſeparate and abſorb the nutritious parts of the aliment, and reject all the groſſer and uſeleſs particles. Theſe ducts, after innumerable communications with each other, unite into one large tube, diſtinguiſhed by the name of the *thoracic duct*, which is the general reſervoir of the chyle, or ſecreted liquor. This chyle, which is a mild fluid, paſſes from the thoracic duct to the ſubclavian vein; and by this vein it is conveyed to the heart, where it mingles with the blood, and is circulated through the body, for the nouriſhment of its different parts. It is of no moment, for our preſent purpoſe, to be more particular, eſpecially as this ſubject will be afterwards more fully handled. I ſhall therefore juſt mention, that there are particular organs or glands for ſecreting various fluids, which are neceſſary to the exiſtence of the larger animals, as the kidneys for the ſecretion of urine; the liver for the ſecretion of gall; the ſtomach for the ſecretion of the gaſtric juices; the ſalivary glands for the ſecretion of ſaliva, &c.

From this ſketch of the ſtructure of man and of quadrupeds, very little attention is neceſſary to perceive, that Nature purſues a ſimilar plan in the formation of birds and fiſhes.

In that numerous claſs of animals diſtinguiſhed by the name of *inſects*, there is a great variety of form and ſtructure. In many of theſe, Nature ſeems to depart from her general mode of operation. But, upon a more accurate examination, this ſeeming departure will appear to be only an extenſion of that univerſal plan which ſhe obſerves in the formation of all animated beings. Some inſects, the lobſter, and all the cruſtaceous and ſhell animals, have their bones on the outſide of their bodies. To theſe bones the muſcles and other inſtruments of motion are attached. Many ſpecies have no bones; but their bodies conſiſt of a ſucceſſion of rings incaſed into each other. By contracting and dilating theſe rings, all the movements of this kind are performed. The head, in ſome ſpecies, changes its form every moment. It contracts or dilates, appears or diſappears, at the pleaſure of the animal. Theſe motions are permitted by the flexibility of the membranes, or coverings of the head. In other ſpecies, the form of the head is permanent, owing to the hardneſs of the coverings, which are ſcaley or cruſtaceous, and approaches nearer to that of the more perfect animals.

Many inſects are deſtitute of particular organs. Some want eyes, ears, brain, and noſtrils. Other have an acute ſenſe of ſmelling, though we know not the form or ſituation of the organ. The inferior ſpecies of inſects have no internal lungs, but receive air by lateral pores, and ſometimes by long tubes, or tracheae, which protrude from different parts of the body. Many inſects have no heart, or general reſervoir for the reception and propulſion of the blood. But we diſcover by the microſcope, that their blood circulates by the pulſation of arteries, and that their different fluids are ſecreted by glands. In a word, Nature, in the ſtructure and functions of animals, deſcends, by degrees almoſt imperceptible, from man to the polypus, a being which, ever ſince its oeconomy and properties were diſcovered by M. Trembley, has continued to aſtoniſh both philoſophers and naturaliſts. The ſtructure of the polypus, which inhabits freſh water pools and ditches, is extremely ſimple. Its body conſiſts of a ſingle tube, with long *tentacula*, or arms, at one extremity, by which it ſeizes ſmall worms, and conveys them to its mouth. It has no proper head, heart, ſtomach, or inteſtines of any kind. This ſimplicity of ſtructure gives riſe to an equal ſimplicity in the oeconomy and functions of the animal. The polypus, though it has not the diſtinction of ſex, is extremely prolific. When about to multiply, a ſmall protuberance or bud appears on the ſurface of its body. This bud gradually ſwells and extends. It includes not a young polypus, but is the real animal in miniature, united to the mother as a ſucker to the parent-tree. The food taken by the mother paſſes into the young by means of a communicating aperture. When the ſhooting polypus has acquired a certain growth, this aperture gradually cloſes, and the young drops off, to multiply its ſpecies in the ſame manner. As every part of a polypus is capable of ſending off ſhoots, it often happens, that the young, before parting from the mother, begin to ſhoot; and the parent-animal carries ſeveral generations on her own body. There is another ſingularity in the hiſtory of the polypus. When cut to pieces in every direction fancy can ſuggeſt, it not only continues to exiſt, but each ſection ſoon becomes an animal of the ſame kind. What is ſtill more ſurpriſing, when inverted as a man inverts the finger of a glove, the polypus ſeems to have ſuffered no material injury; for it ſoon begins to take food, and to perform every other natural function. Here we have a wonderful inſtance of animal ductility. No diviſion, however minute, can deprive theſe worms of life. What infallibly deſtroys other animals, ſerves only, in the polypus, to multiply the number of individuals. M. Trembley, in the courſe of his experiments, diſcovered, that different portions of one polypus could be ingrafted on another. Two tranſverſe ſections brought into contact quickly unite, and form one animal, though each ſection belongs to a different ſpecies. The head of one ſpecies may be ingrafted on the body of another. When a polypus is introduced by the tail into another's body, the two heads unite, and form one individual. Purſuing theſe ſtrange operations, M. Trembley gave ſcope to his fancy, and, by repeatedly ſplitting the head and part of the body, formed hydras more complicated than ever ſtruck the imagination of the moſt romantic fabuliſts.

This ſhort account of the general ſtructure of animals was a neceſſary preparation for perceiving more clearly their connection with the vegetable kingdom.

The ſtructure of plants, like that of animals, conſiſts of a ſeries of veſſels diſpoſed in a regular order. Theſe veſſels are deſtined to perform the different functions neceſſary to the nouriſhment, growth, and diſſemination of the plant. In trees, and moſt of the larger vegetables, three diſtinct parts are to be obſerved; the bark, the wood, and the pith. The bark likewiſe conſiſts of three parts; the ſkin, the body, and the *liber*, or inner circle; which laſt, about the end of autumn, aſſumes the ſame texture and firmneſs with the wood. The ſubſtance of the bark is compoſed of a number of longitudinal ſap and air veſſels, which have the appearance of fine threads, running from the root to the trunk and branches. Beſide theſe veſſels, the bark is furniſhed with a parenchymatous or pulpy ſubſtance, in which there are a vaſt variety of *folliculi*, or ſmall bladders. The bark is connected to the wood by tranſverſe inſertions of the parenchyma.

The wood conſiſts of two diſtinct ſubſtances; the one is denſe, and compact, and conſtitutes what is termed the *ligneous body;* the other is porous, moiſt, and pulpy, and is therefore called the *parenchymatous* part of the wood. A portion of wood is placed alternately between a ſimilar portion of parenchyma. Theſe alternate portions proceed from the edges of the pith, as *radii* from the center of a circle, widening proportionally as they approach the circumference. Both of them, however, like the bark, are furniſhed with numberleſs ſap and air veſſels.

The pith or heart is bounded on all ſides by the wood, and is compoſed of the ſame materials: It is nothing but a vaſt congeries of air and ſap veſſels, interwoven with the parenchyma and bladders, not unlike the tiſſue of gauze or lace. This texture is common to every part of the trunk, being only more cloſe and compact in the bark and wood than in the pith. It is well known, that the pith of plants diminiſhes in proportion to their age. The reaſon is obvious: Every year the ring of veſſels, which lies contiguous to the wood, dries, condenſes, and becomes wood.

The leaves of vegetables conſiſt of a fine ſkin, which incloſes the parenchyma or pulp. This ſkin, like that of animals, is an organic body, furniſhed with an immenſe number of parenchymatous and ligneous fibres, and interwoven in a manner preciſely ſimilar to that of the trunk and branches. When the ſkin is removed, the pulp appears, and is every where interſperſed with ſmall cylindrical fibres, wound up into minute bladders. A large nerve runs along the middle of every leaf, and continually ſends off branches, which gradually decreaſe in magnitude, till they reach the edge or diſc. This principal nerve is a collection of ſmall tubes, which, at proper diſtances, go off, and are diſtributed over the leaf in a manner preciſely ſimilar to the diſtribution of the nerves over the human body.

With regard to flowers and fruits, their general texture is the ſame with that of the parts already deſcribed, differing only in various proportions of the ligneous veſſels and parenchymatous or pulpy ſubſtance. That vegetables are poſſeſſed of ſecretory glands, is apparent from the almoſt infinite variety of their taſtes, odours, and colours. Theſe ſenſible qualities differ even in different parts of the ſame plant. But the glandular ſecretion of vegetables is moſt conſpicuous in the flowers and fruit. Many flowers ſecrete a nectareous fluid, which is more grateful to the palate than the fineſt honey. The glands of ſome fruits, as thoſe of the lemon and orange, ſecrete liquors of very different qualities. The veſſels of the rhind contain an acrid eſſential oil, while thoſe of the parenchyma or pulp ſecrete an agreeable acid.

This ſimilarity in the general ſtructure of animals and plants is ſtrongly corroborated by the analogous parts in both being deſtined to anſwer the ſame purpoſes.

The oeconomy and functions of vegetables, as well as thoſe of animals, are the reſults of a vaſcular texture. Each of theſe claſſes of beings have veſſels deſtined to the performance of ſimilar offices. In man and quadrupeds, the fluids are circulated by the pulſation of the heart and arteries. The juices of plants do not circulate; but they are raiſed from the root to the trunk, branches, leaves, flowers, and fruit, by the ſap-veſſels. The aſcenſion of the ſap has been aſcribed to capillary attraction. But, though no motion is perceptible in the ſap-veſſels ſimilar to the pulſation of arteries; yet, both the propulſion of the ſap, which moves with great force, and the ſecretion of different fluids by different parts of the ſame plant, imply an action in theſe veſſels. In animals, the gall, the urine, the ſaliva, are all concocted from the general maſs of blood by the action of particular veſſels. Fluids of theſe different qualities exiſt not in the blood itſelf: They are created by an incomprehenſible operation of the veſſels peculiar to their reſpective glands. In plants, the ſap aſcends, and different fluids are ſecreted from it by glandular veſſels. Here the ſame effects are produced both in the animal and the plant. We muſt, therefore, attribute them to the ſame cauſe, namely, the action of veſſels. Beſides, the ſap, which is the blood of plants, moves with a force often equivalent to the weight of the atmoſphere. M. Bonnet remarks *, that he has ſeen, by means of coloured liquors, the vegetable ſap move three inches in an hour; and Dr Hales, in his Statics, has ſhown, that the leaves are the principal organs of tranſpiration. He likewiſe conſiders them to be the inſtruments which raiſe the ſap. But it has ſince been diſcovered, that coloured liquors riſe equally high in branches deprived of leaves, and that they do not riſe at all in dried plants. Hence the ſap of vegetables is not taken up in the ſame manner as a ſpunge imbibes water, but is forced to aſcend by an unknown action of the veſſels. The ſpring of the tracheae may put in motion the air they contain, and that air may have ſome influence on the general movement. But, by whatever powers the ſap

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* Oeuvres, tom. 1. p. 140.

ſap is moved, the exiſtence of the motion is certain; and it is equally certain, that this movement of the ſap produces the ſame effects in the vegetable, that the force of the heart and arteries does in the animal.

The motion of the ſap, in vegetables, is not properly a circulation ſimilar to that of the blood in the more perfect animals. It aſcends and deſcends in the ſame veſſels; and theſe motions are evidently affected by heat and cold. The ſap riſes copiouſly in a warm day, and deſcends during the night, nearly in the ſame manner as the mercury riſes and falls in the thermometer. But, though the analogy here fails with regard to man and the larger animals, yet it holds in the taenia, the polypus, and many other inſects, which exhibit not the ſmalleſt veſtiges of circulation in their juices.

The pith, or medullary ſubſtance of plants, has ſome reſemblance to the brain and ſpinal-marrow of animals. When the texture of the brain or ſpinal-marrow is deſtroyed, life is extinguiſhed; and, when the pith of plants is deſtroyed or dried up by age, they no longer retain the power of vegetating. The leaves of plants are analogous to the lungs of animals. It is by the lungs that the perſpiration of animals is chiefly effected; and plants diſcharge moſt of their ſuperfluous moiſture by the leaves. They expoſe a large ſurface to the action of the ſun, which produces a tranſpiration ſo copious, that ſome plants throw out fifteen or twenty times more in a given period, than is diſcharged from the human body. When a plant is deprived of its leaves in ſummer, inſtead of ripening its fruit, it is in great danger of dying for want of thoſe organs which carry off the ſuperfluous juices that ariſe from the root. A plant, in this ſituation, may be conſidered as labouring under an aſthma, or dying of a ſuffocation.

Beſide the leaves, plants tranſpire by the pores of the ſkin. But the quantity emitted in this manner is not nearly equal to that which iſſues from the leaves.* The ſame thing happens with regard to man and quadrupeds. Though they likewiſe perſpire through the ſkin, yet by much the greater quantity of perſpirable matter is diſcharged by the lungs. Beſide throwing out ſuperfluous or noxious matter by the leaves, plants, by the ſame organs, abſorb from the atmoſphere, and perhaps from the ſun's rays, ſome unknown matter, which is neceſſary to their exiſtence. The lungs of animals likewiſe derive, from the ſame ſources, a particular matter or principle, without which life could not long be continued.

Another analogy between the ſtructure of plants and animals merits obſervation. The round bones of animals conſiſt of concentric ſtrata or plates, which can be eaſily ſeparated; and the wood of plants conſiſt of concentric layers of hardened veſſels, which ſeparate when macerated in water. A tree acquires an additional ring every year; and, by counting theſe rings, a pretty exact eſtimation of its age may be attained.

The branches of plants have been conſidered as analogous to the arms or tentacula of animals. But this is one of thoſe ſtrained analogies which ſhould be carefully avoided. The great uſe of branches is evident. By producing an amaſing number of leaves, a large ſurface is expoſed to the air and ſun, to anſwer the important purpoſes of tranſpiration and abſorption. If there is any thing in plants analogous to the arms or tentacula of animals, it muſt be confined to ſuch ſpecies as twiſt themſelves around poles or trees, as the ivy, the vine, the convolvulus, &c. and to ſuch as ſupport their trunks on other bodies by means of little hooks, as the gooſe-graſs, and many other kinds.

All theſe analogies, it may be remarked, are confined to large animals and large vegetables; but they hold not in that numerous tribe of plants called *graſſes*. Inſtead of being filled with wood and pith, their ſtems are perfectly hollow; and, to fortify theſe plants, Nature has beſtowed on them ſtrong joints or knots, which are placed at regular diſtances in each ſpecies. But, though ſome of the analogies which ſubſiſt between the larger animals and vegetables exiſt not in the ſmaller plants, this circumſtance, inſtead of infringing, confirms the general plan of Nature. To diſcover the analogies between tubular plants and animals, we muſt examine the ſtructure of the minuter tribes of animated beings. The graſſes have neither pith nor wood internally; and the polypus, the taenia, and many other inſects, have no bones, heart, or inteſtines, but are ſimple tubes, perfectly reſembling the empty ſtems of the gramineous plants. Beſides, the ligneous, or at leaſt the herbaceous part of theſe plants, is placed on the outſide, ſimilar to the cruſtaceous and ſhell animals, whoſe bones are ſituated externally. Another analogy muſt not be omitted. The ſucculent vegetables, ſuch as the houſe-leek, the muſhroom tribes, and many ſea-plants, conſiſt almoſt entirely of a pulpy or parenchymatous ſubſtance, and may be cruſhed to a jelly by the ſlighteſt preſſure. The texture of worms, caterpillars, and of all the ſoft inſects, is extremely ſimilar to that of the ſucculent vegetables.

II.—GROWTH AND NOURISHMENT.

THE ſecond ſource of analogies between the plant and animal is derived from the modes of their growth and nouriſhment.

Many ingenious theories have been invented, with a view to explain the myſterious operation by which the growth and nouriſhment

ment of animals and vegetables are effected. But I ſhall confine myſelf, at preſent, to ſuch remarks as are purely analogical, and may be fully underſtood without a minute knowledge of the different ways by which growth and nouriſhment have been ſuppoſed to be accompliſhed.

Animals, like vegetables, gradually expand from an embryo or gelatinous ſtate, and, according to their kinds, arrive ſooner or later at perfection. This expanſion and augmentation of ſubſtance is the idea conveyed by the word *growth*. Without ſome nutritious matter taken into the body, and aſſimilated, by the action of veſſels, to the ſubſtance of the being that receives it, growth cannot take place. Moiſture is the chief food of plants. But the food of animals, in general, varies with the ſpecies. This fact led ſome philoſophers to conclude, that every plant extracted from the ſoil a food peculiar to its own nature. It was, however, afterwards diſcovered, by repeated experiments, that vegetables can grow, and acquire a very conſiderable degree of bulk and weight, without exhauſting a perceptible quantity of the earth in which they are planted. Theſe experiments are a ſufficient proof, that moiſture conſtitutes the chief nouriſhment of plants. They likewiſe indicate, that vegetables, however diverſified in their figure, denſity, and fibrous arrangement, are more ſimple in their texture than animals. But, notwithſtanding theſe ſeeming differences in the nouriſhment of plants and animals, Nature fails not to obſerve the ſame courſe in both kingdoms. The food of the animal, before it is converted into nouriſhment, muſt go through the intricate proceſs of digeſtion. But, after the food has been converted into chyle, and the chyle into blood, this blood becomes a common fluid, from which all nouriſhment and all animal fluids are derived. Here the analogy is apparent. Moiſture is to the plant preciſely what blood is to the animal. Each of them extracts its nouriſhment from a common fluid; and, in both, this fluid is changed, by the action of veſſels, into the various juices peculiar to the different ſpecies.

When growth firſt commences, the embryos of plants and animals are in ſimilar circumſtances. Soon after conception, the foetus is incloſed in its membranes, and is nouriſhed, till mature for birth, by blood which it receives from the uterus and placenta. In the ſame manner, the embryo of a plant is incloſed in the membranes of the ſeed; and its fibrous roots are ſpread over the lobes or pulpy part. After the ſeed is ſown, and vegetation commences, the embryo is nouriſhed by moiſture, which the lobes abſorb from the earth, and convey it to the minute tubes of the ſeminal root. In many plants, theſe lobes riſe above the ſurface of the ground, in the form of leaves, and continue to nouriſh and protect the tender plume or ſtem, till it acquires ſtrength ſufficient to ſupport the aſſaults of the air and weather. A plant, in this ſituation, may be ſaid to have two roots; one, the fibres of which are diffuſed through the ſubſtance of the lobes, or ſeminal leaves, and another attached to the ſoil.

The nouriſhment thus conveyed to vegetables by the ſeminal leaves, is extremely analogous to that of animals by the milk of the mother. The texture of young animals is ſo lax and unelaſtic, that the food ſuited to maturer years would ſoon put a period to their exiſtence. But Nature has provided againſt this inconveniency. She has endowed females with a ſet of veſſels deſtined for the ſecretion of a mild liquor, ſo far concocted and animalized as to be adapted to the tender and flaccid condition of their young. A ſimilar proviſion of nouriſhment is afforded to the young vegetable. For ſome time after the plume and radicle have begun to ſhoot, their texture is ſo extremely tender, that they are unable to ſupport each other without ſome foreign aid. This aid is afforded them by the ſeminal leaves. Theſe leaves abſorb dews, air, and other fine fluids, which are concocted and aſſimilated in the veſſels of the ſeminal root, and then conveyed, in a kind of vegetable form, to the feeble veſſels of the plume. Hence it is apparent, that the nouriſhing of young animals by milk, and of young vegetables by ſeminal leaves, is the ſame inſtitution of Nature, and effected by ſimilar inſtruments.

Plants, like animals, paſs gradually from an embryo, or infant ſtate, to that of puberty. At this period of their exiſtence, they have acquired that firmneſs of texture, and that evolution of parts, which conſtitute the perfection of their natures, and enable them to produce beings every way ſimilar to themſelves. In both kingdoms, the age of puberty arrives later or more early, according to the difference of ſpecies. Some animals live a few months only. Many of the inſect tribes are produced, grow to maturity, propagate their kind, and die in the courſe of a ſingle ſeaſon. Others, as ſeveral flies, beetles, &c. exiſt two years. Thus animals have a progreſſive duration of life. The dormouſe lives ſix years, the hare ſeven or eight, the bear twenty or twenty-five, the camel forty or fifty, the rhinoceros ſeventy or eighty, the elephant two hundred; and ſome birds and fiſhes are ſuppoſed to exiſt during three or four centuries. The ſame progreſſive duration takes place among vegetables. Some plants are annual, as moſt of the eſculent kinds; others, as the hedge-parſley, the wild carrot, the parſnip, the fox-glove, the ſcurvy-graſs, &c. are biennial; others exiſt three, five, ſeven, ten, twenty, thirty, ſixty, and a hundred years; and the oak, like the elephant and thoſe birds and fiſhes which are famed for longevity, continues to adorn the foreſt for ſeveral centuries.

The manner by which the nutritious particles are extracted from food, is very ſimilar in the animal and the plant. In the animal, this operation is performed by the lacteal veſſels, which are diſtributed over the internal ſurface of the ſtomach and inteſtines. In the plant, the ſame office is performed by the veſſels of the root and leaves. Hence animals are organized beings nouriſhed by roots ſituated within their bodies; and plants are organized bodies which abſorb their nouriſhment by roots placed externally. Beſides, in all viviparous animals, the foetus is nouriſhed, not by food taken in at the mouth, but by veſſels attached to the placenta. Theſe veſſels perform the ſame office to the foetus, that roots do to vegetables.

Warmth and moiſture are favourable to the production of large and juicy plants; and the animals that feed upon theſe ſucculent and rich vegetables, are likewiſe larger than thoſe which inhabit cold countries, where the plants are ſmaller, more rigid, and contain fewer nutritive particles.

Some plants grow in particular climates only. The *rubus arcticus*, a ſpecies of bramble, ſo common in Norway and Canada, hardly endures the climate of Upſal, in Sweden. But the *alſine media*, or chickweed, and ſeveral graſſes, are diffuſed over almoſt the whole globe. In the ſame manner, ſome animals, as the camel, the rhinoceros, and the elephant, are produced in warm climates only; while others, as the rein-deer, glutton, and marmot, are confined to the colder regions of the earth; and man, in the animal, like ſome graſſes in the vegetable kingdom, is univerſal, and inhabits every climate.

Some plants, as well as ſome animals, are amphibious, as the ruſh and the frog; others are paraſites, and feed on the juices they extract

tract from different ſpecies to which they adhere. The miſſeltoe, for example, feeds upon the oak; moſt trees afford nouriſhment to certain moſſes and fungous plants; and every animal is fed upon by ſmaller kinds.

The growth of plants, like that of animals, may be accelerated or retarded by promoting or checking their perſpiration, and by excluding them from proper exerciſe and air. When men, or other animals, are confined to ſituations which prevent the free acceſs of pure air, their growth is retarded; and their ſickly colour indicates a defect of vigour. Plants, when placed in ſimilar circumſtances, are always weak, dwarfiſh, and unnaturally coloured. But exerciſe is equally neceſſary to the health and vigour of plants, as it is to thoſe of animals. The exerciſe of animals is effected by various kinds of ſpontaneous motion. Plants are likewiſe exerciſed by motion; but that motion is not voluntary: It is communicated to them by the action of the air. The agitation which they receive from the winds enables them to extend their roots, prevents them from a growth too rapid, and, of courſe, ſtrengthens their whole fabric. It is owing to the want of this agitation, that plants brought up in houſes, or in other confined ſituations, ſhoot out to an unnatural length; that their ſtems and branches are always ſlender and weak; and that they ripen not their fruit like thoſe which are expoſed to the open air.

To conclude this branch of the ſubject, plants and animals are ſo nearly allied, that their growth and nouriſhment are not only effected by ſimilar inſtruments, but ſome parts of animal bodies evidently partake of a vegetable nature. Thus, the hairs, the nails, the beaks, and the horns, are a ſpecies of vegetables, as appears from their comparative total inſenſibility, as well as from the mode of their growth and reproduction.

III.—DISSEMINATION AND DECAY.

WE ſhall next take an analogical view of the diſſemination and decay of the animal and vegetable.

The power of reproduction is peculiar to the plant and animal. Each of them is capable of producing beings every way ſimilar to the parent. But the modes by which this ſingular effect is accompliſhed, are very different in appearance. It is our preſent purpoſe to remove this apparent difference, and to ſhow that animals and vegetables multiply their ſpecies in a manner extremely analogous.

Animals have long been divided into viviparous and oviparous. The one claſs produce their young alive, the other lay eggs, which muſt be hatched either by the heat of the ſun, or by that of the mother. This diviſion, though very comprehenſive, is not perfect. Several animals have lately been diſcovered which are neither viviparous nor oviparous; and there are animals which unite both theſe modes of multiplication.

The viviparous claſs comprehends men, quadrupeds, and ſome fiſhes, reptiles, and inſects. The oviparous includes birds, ſome reptiles, and moſt of the inſect tribes. But the armed polypus, or *hydra* of Linnaeus, inſtead of being either viviparous or oviparous, multiplies its ſpecies, as formerly remarked, by ſending off ſhoots from the body of the parent.

Another ſpecies, called the *bell-polypus*, or *hydra ſtentorea* of Linnaeus, multiplies by ſplitting longitudinally. In twenty-four hours, theſe diviſions, which adhere to a common pedicle, reſplit, and form four diſtinct animals. Theſe four, in an equal time, again ſplit; and thus they proceed doubling their numbers daily, till they acquire a figure ſomewhat reſembling a noſegay. The young afterwards ſeparate from the parent ſtock, attach themſelves to the roots or leaves of aquatic plants, and each individual gives riſe to a new colony.

The funnel-ſhaped polypus multiplies by ſplitting tranſverſely. Of the individuals, accordingly, which proceed from this diviſion, one has the old head and a new tail, and the other a new head and the old tail. The ſuperior diviſion ſwims off, and fixes itſelf to ſome other ſubſtance; but the inferior diviſion remains attached to the former pedicle.

The dart-millepes affords another example of multiplication by ſpontaneous ſeparation. This inſect divides, about two-thirds below the head, into two diſtinct and perfect animals; and it ſeems to poſſeſs no other mode of continuing the ſpecies.

The multiplication of the various animalcules which appear in infuſions of animal and vegetable ſubſtances, long occupied the attention, and eluded the reſearches of philoſophers. This diſcovery of the increaſe of ſome larger animals by ſpontaneous diviſion, gave riſe to the conjecture, that theſe microſcopic animalcules might multiply their numbers in a ſimilar manner. This conjecture was communicated to M. de Sauſſure in a letter from Bonnet, who received an anſwer, dated at Genoa, September 28. 1769, to the following purpoſe.

‘ What you propoſe as a doubt,’ ſays M. de Sauſſure, ‘ I have ‘ verified by inconteſtible experiments, namely, that infuſion-ani‘ malcules multiply by continued diviſions and ſubdiviſions. Thoſe

‘ roundiſh or oval animalcules that have no beak or hook on the ‘ fore part of their bodies, divide tranſverſely. A kind of ſtricture ‘ or ſtrangulation begins about the middle of the body, which gra-‘ gually increaſes, till the two parts adhere by a ſmall thread only. ‘ Then both parts make repeated efforts, till the diviſion is com-‘ pleted. For ſome time after ſeparation, the two animals remain ‘ in a ſeemingly torpid ſtate. They afterwards begin to ſwim about ‘ briſkly. Each part is only one half the ſize of the whole: But ‘ they ſoon acquire the magnitude peculiar to the ſpecies, and mul-‘ tiply by ſimilar diviſions.’——‘ To obviate every doubt,’ continues our author, ‘ I put a ſingle animalcule into a drop of water, ‘ which ſplit before my eyes. Next day, I had five, the day after, ‘ ſixty, and, on the third day, their number was ſo great, that it ‘ was impoſſible to count them *.

‘ Another ſpecies, with a beak or horn on the fore part of its ‘ body, which I obtained from an infuſion of hemp-ſeed, multi-‘ plied likewiſe by diviſion, but in a manner ſtill more ſingular ‘ than the former. This animalcule, when about to divide, at-‘ taches itſelf to the bottom of the infuſion, contracts its body, ‘ which is naturally oblong, into a ſpherical form, ſo that the beak ‘ entirely diſappears. It then begins to move briſkly round, ſome-‘ times from right to left, and ſometimes from left to right, the ‘ centre of motion being always fixed. Towards the end, its mo-‘ tion accelerates, and, inſtead of a uniform ſphere, two croſs-like ‘ diviſions begin to appear. Soon after, the creature is greatly agi-‘ tated, and ſplits into four animalcules perfectly ſimilar, though ‘ ſmaller than that from which they were produced. Theſe four ‘ increaſe to the uſual ſize, and each, in its turn, ſubdivides into ‘ other four †,’ &c.

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* La Palingeneſie Philoſophique, par C. Bonnet, tom. I. p. 428. 429.

† Idem, p. 430.

The beauties of Nature have been juſtly celebrated in the uniformity of her productions. This uniformity was early remarked, and gave riſe to the ancient diviſion of animals into viviparous and oviparous, which continued to be adopted as an univerſal maxim till within theſe hundred years. Before this period, it was believed by philoſophers, that all animals were either brought forth alive, or hatched from eggs. Among the ancients, indeed, and even down to the time of the celebrated Redi, this maxim included chiefly the more perfect animals; for, with regard to moſt of the inſect tribes, they imagined that theſe were produced by putrefaction, and the admixture of particular kinds of matter. But Redi, by a ſeries of unqueſtionable experiments, exploded the doctrine of the equivocal generation of inſects; and then the maxim, without farther inveſtigation, was extended to the whole animal kingdom. Redi's experiments and remarks turned the attention of philoſophers to the minuter tribes of animals. In the courſe of a few years, accordingly, ſeveral eminent men aroſe. Reaumur, Bonnet, Trembley, Ellis, Spalanzani, and a multitude of other writers, opened new views with regard to the manners and oeconomy of animated beings. M. Bonnet has furniſhed inconteſtible evidence, that ſeveral ſpecies of the puceron, or vine-fretter, are both oviparous and viviparous. In ſummer, theſe inſects bring forth their young alive; but, in autumn, they depoſit eggs upon the bark and branches of trees. Here the intention of Nature is apparent. The puceron is unable to ſurvive the winter colds; and, therefore, though viviparous during the warm months, the ſpecies could not be continued without this wiſe proviſion. The puceron, it ſhould appear, is naturally diſpoſed to produce live young. The foetus is incloſed in a membrane, which, like that of the larger animals, burſts before excluſion. But, when the cold ſeaſon commences, the general texture of the animals, as

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* Traité d'Inſectologie, par C. Bonnet, tom. 1. p. 194.—202.

well as of the membranes incloſing the foetus, becomes more firm and tenacious; and this, perhaps, is the phyſical reaſon why they are viviparous in ſummer, and oviparous in autumn. Many other flies are known to be viviparous. Upon farther examination, all theſe will probably be diſcovered to be alſo oviparous *.

The puceron exhibits another phaenomenon ſtill more ſingular. The maxim, that multiplication preſuppoſed impregnation by ſexual embraces, was formerly thought to be univerſal. Neither ſhould the reception of this maxim be regarded as a matter of wonder; for it was founded on a very general and ſtrong analogy. But the following facts ſhow, that Nature, though uniform in many ſteps of her progreſs, is not invariably limited to the ſame mode of operation.

On the 20th day of May, M. Bonnet took a young puceron, the moment after dropping from the womb of its mother, and ſhut it up in a glaſs veſſel, to prevent all poſſibility of communication with any individual of the ſpecies. A ſprig of the tree on which the animal was produced, ſupplied it with nouriſhment. The creature changed its ſkin four times, namely, on the 23d, 26th, 29th, and 31ſt days of the ſame month. After a minute detail of circumſtances, M. Bonnet informs us, that his impriſoned puceron grew with rapidity; that, on the 1ſt day of June, it brought forth; and that, from this day to the 21ſt, it produced no leſs than 95 young, all full of life and vigour †. He frequently repeated this experiment, and it was always followed with the ſame event.

M. Bonnet, ſuſpecting that a ſingle impregnation might influence both the mother and her immediate offspring, reſolved to obviate

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* See Reaumur, tom. 8. edit. 12mo, p. 153. *et ſeq.*

† Bonnet, Traité d'Inſectologie, tom. 1. p. 39.; and Reaumur, tom. 12. p. 353.

viate every difficulty. For this purpoſe, he confined, in ſeparate glaſſes, the young of ſucceſſive births, as they dropped from their mothers. Each of theſe, however, were equally fertile, though he continued the experiment to the ninth generation from the original parent *.

Facts of this kind, which ſeem to interrupt the ordinary current of Nature, ſhould inſpire philoſophers with caution. They ſhould create reverence for ſuch of her operations as are already known; but they ſhould likewiſe check that raſh ſpirit which too frequently draws unlimited concluſions, before the ſubject be fully inveſtigated. Of all inductions regarding the hiſtory of Nature, the neceſſity of ſexual commerce for multiplying the ſpecies appeared to be the moſt general and the moſt legitimate. The oeconomy of the puceron, however, demonſtrates, that even this law is not indiſpenſable, and that Nature has the power of changing her ſteps, and of accompliſhing the ſame purpoſes by various means.

Having enumerated the different modes by which animals multiply their ſpecies, I ſhall next ſhow, that the multiplication of vegetables is extremely analogous.

The viviparous, as well as the oviparous animals, are ſuppoſed to proceed from eggs, with this difference, that the young of the viviparous are hatched in the uterus previous to their excluſion.

Many ſtriking analogies ſubſiſt between the eggs of animals and the ſeeds of plants. When placed in proper circumſtances, they both produce young every way ſimilar to the parents. To accompliſh this wonderful effect, the egg requires impregnation and heat. Moiſture,

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* Bonnet, Traité d'Inſectologie, tom. 1. p. 74. *et ſeq.*

Moiſture, warmth, and ſoil, or ſome ſimilar matrix, are neceſſary for the excluſion of the young plant. This analogy has been extended much farther by Linnaeus, and other ſupporters of the ſexual ſyſtem of plants. They maintain, that impregnation is equally indiſpenſable to the vegetation of the ſeed, as to the fertility of the egg. But, as this doctrine will be diſcuſſed when we come to treat of ſexes in general, we ſhall here diſmiſs it without farther remark.

Eggs are not only analogous to ſeeds, in their general deſtination of reproducing individuals, and continuing the ſpecies, but there is a great ſimilarity in the ſtructure and uſes of their reſpective organs.

The internal parts of the egg are covered with a cruſt or ſhell, and two membranes. Beſide theſe, the yoke is included in a ſeparate membrane. When the two firſt membranes are removed, the white appears every way inveſting the yoke. In the white, or rather on the membrane of the yoke, a ſmall cicatrice is diſcernible, in the centre of which is the *punctum ſaliens*, or embryo of the future animal. After two or three days incubation, this *punctum ſaliens* becomes red, and ſhoots out blood-veſſels, which are diſperſed through the yoke, in the ſame manner as the veſſels of a foetus are diſtributed over the placenta.

A ſeed is likewiſe covered with a ſhell, or cruſtaceous membrane. Another membrane inveſts the whole kernel, or pulpy lobes of the ſeed. Each lobe, like the yoke of the egg, is involved in a ſeparate membrane. In every ſeed there is alſo a ſmall cicatrice, or aperture, through which the young plant iſſues. Immediately under this cicatrice, the plume, or future plant, is diſcernible, reſembling the *punctum ſaliens* of the egg. The branches of the radicle proceed from this plume, and are diſperſed through the ſubſtance of the lobes, in the ſame manner as the blood-veſſels iſſue from the *punc-*

tum ſaliens of the egg, and are diſtributed over the yoke. It is by the pulp of the lobes that the radicle and plume are nouriſhed, till the one ſhoots down into the ſoil, and the other mounts above the ſurface. In ſeeds, there is nothing analogous to the white of an egg. Such a proviſion would have been ſuperfluous; for the earth, in which the ſeeds are to germinate, muſt always be moiſt, otherwiſe the young plant could not receive nouriſhment, after iſſuing from the ſeed. Beſides, the eggs of fiſhes have no white, becauſe they are perpetually moiſtened with water.

The analogies ariſing from the multiplication of animals and plants, by means of eggs and ſeeds, are the moſt common, and the moſt obvious. Eggs and ſeeds are evidently organs formed on the ſame plan, and deſtined by Nature to anſwer the ſame general intention: But the multiplication of plants, as well as that of animals, is not confined ſolely to one mode.

The young of viviparous animals, though they probably originate from ſmall eggs, are not brought forth till they have acquired a certain age and firmneſs of texture. It may be thought, that there is no multiplication of plants which has any reſemblance to that of viviparous animals. We ſhould reflect, however, that plants can multiply by buds. Now, a bud has no analogy, either in texture or appearance, to a ſeed. Buds ariſe from the ſtems or branches of vegetables. One object in their formation is to produce leaves and branches, as well as to extend the length of the trunk or ſtem. But they are likewiſe endowed with the faculty of reproducing new individuals. In this reſpect, trees and ſhrubs may be conſidered as viviparous plants; becauſe they produce out of their own bodies an organ, which, though differing in every view from a ſeed, is brought forth alive, and, when properly cheriſhed, is converted into a being perfectly ſimilar to the parent, and capable of continuing its ſpecies. The embryo of a bud commences its exiſtence under the bark. Here it remains, for ſome time, incloſed in membranous coverings, and attached to the bark by minute fibres, which convey to it a nouriſhment ſuited to its condition. When arrived at a certain ſize and conſiſtence, it pierces the bark, and ſhoots out into the open air. If allowed to remain on the parent, it ſoon burſts through its membranes, and, in time, gives riſe to a new branch: But, when detached from the parent, and placed in proper circumſtances, it becomes a new individual of the ſame ſpecies.

Bulbous rooted plants furniſh a ſtill ſtronger analogy between the increaſe of viviparous animals and that of vegetables. In the end of autumn, if the coats of any bulbous root be carefully diſſected, the entire plant in miniature will appear in the centre of the root. In ſpring, this ſmall plant, like a foetus incloſed in the uterus, pierces the coats of which the root conſiſts, and gradually grows till it flowers, ripens its ſeeds, and dies at the approach of winter, when a new plant is again formed in the old root. Here we have an example of the multiplication of plants ſimilar to that of the puceron; but the order of time is reverſed. The puceron is viviparous in ſummer, and oviparous in autumn; but bulbous-rooted plants may be conſidered as oviparous in ſummer, and viviparous in autumn.

The ſame analogy is to be traced in thoſe roots which have what are called *eyes*, like the potatoe. Theſe eyes are all plants in miniature, which live in that ſtate during the winter, and, when committed to the ſoil, come to maturity in ſummer.

There are ſtill other modes of multiplying common to the animal and vegetable. Many plants are multiplied by ſuckers, ſlips, and cuttings.

The animal kingdom furniſhes examples of all theſe modes of multiplication. The ſuckers of plants have an exact analogy to the ſhoots of a polypus. When ſeparated from the parent, the ſucker becomes a perfect plant, and the ſhoot of the polypus a perfect animal. Plants are capable of multiplication by ſlips and cuttings: And the portions of a polypus, however ſmall, or when cut in any direction, reproduce, and become perfect animals of the ſame ſpecies.

But ſome ſpecies of the polypus, the dart-millepes, and ſeveral animalcules which appear in infuſions of animal and vegetable ſubſtances, multiply by ſplitting, or ſpontaneous ſeparation. Here the analogy between the animal and vegetable might be ſuppoſed to fail. The water-lentil, however, a ſmall plant, which covers the ſurface of ſtagnating pools, multiplies its ſpecies by detaching thin films from the under ſide of the leaf. Theſe films or tender leaves produce roots, and vegetate into a regular plant.

We muſt not diſmiſs this ſubject till another analogy be unfolded. All animals have ſeaſons peculiar to their reſpective kinds. Some of the larger animals produce in the ſpring, others in ſummer, others in autumn, and others in winter. With regard to the inſect tribes, their ſeaſons are ſtill more various. Every month, every week of the year, gives birth to different ſpecies. The ſeaſons of plants are diverſified in a ſimilar manner. The growth of different vegetables is diſtributed over the whole year. Particular tribes ſpring up at the ſame uniform periods. In this beautiful diverſity of arrangement, the intentions of Nature are evident. If all plants were to ruſh forward at the ſame time, they would infallibly choke each other. The ſurface of the earth could not afford them room. Nature has therefore wiſely ordained, that the earth ſhould always be covered with plants: But ſhe has alſo ordained, that particular tribes ſhould die at ſtated periods, to make way for the exiſtence of others. The ſame inconvenience would happen, if the production of all animals, and particularly that vaſt number of ſpecies, and that immenſe profuſion of individuals, to which the inſect tribes give birth, were to take place at one period. The air would be ſo crowded with noxious creatures, that neither man nor the larger animals could poſſibly exiſt. Beſides, the ſpecies which feed upon particular plants, if they were produced at a time when theſe plants did not flouriſh, would infallibly periſh for want of food. In Lapland, where the duration of heat is extremely ſhort, the whole inſects which inhabit that dreary and barren region are produced in a few weeks. Though the number of ſpecies, compared with thoſe of the more prolific climates, be very limited, the inconvenience is ſeverely felt. But every natural evil is accompanied with ſome advantage. The rein-deer, upon which the exiſtence of the Laplanders chiefly depends, are tormented by the ſwarms of flies. To avoid their numberleſs enemies, theſe animals leave the vallies, and aſcend the mountains, where the cold is too great for the flies to follow. In theſe lofty regions, the rein-deer feed during the hot ſeaſon, and return to the vallies after the cold has deſtroyed the myriads of inſects. This forced migration has two good effects: It both preſerves the health of the rein-deer, and the vegetables in the vallies, which otherwiſe would have been prematurely exhauſted.

The operation of engrafting was long thought to be peculiar to the vegetable kingdom. But M. Trembley found, that ſeveral ſpecies of the freſh-water polypus could ſucceſsfully undergo this wonderful proceſs. Since his time, it has been diſcovered, that the *actinia*, or ſea-nettle, is likewiſe capable of being engrafted to an individual of the ſame or of a different ſpecies. In all theſe inſtances, the portions of the divided animals grow together, and become diſtinct individuals.

Having traced the general analogies between the ſtructure and oeconomy of the animal and vegetable, from the rudiments of their exiſtence till they have acquired full maturity, and performed the neceſſary office of multiplying their ſpecies, we proceed to the laſt and only melancholy branch of this ſubject, the unavoidable decay and death of every ſucceſſive individual in both kingdoms.

It is an invariable law of Nature, that all organized bodies ſhould have a conſtant tendency to diſſolution. But the periods of their exiſtence vary according to the ſpecies. Previous to actual reſolution, plants as well as animals are ſubject to a number of analogous affections and diſeaſes. When over-heated, plants ſhow evident marks of languor and fatigue: Their leaves become flaccid, their ſtems and branches bend toward the earth, their juices evaporate, and their whole texture aſſumes the appearances of weakneſs and decay. The application of too great a degree of cold makes the flowers, the leaves, the bark, and even the woody fibres, ſhrivel and contract in their dimenſions. When deprived of proper light and air, their colours fade, and they ſoon acquire a lurid and ſickly aſpect. They are likewiſe ſubject to be ſtarved for want of nouriſhment. The growth of plants, as well as that of animals, is checked by ſcanty ſupplies of food. When the ſoil or ſituation is unkindly, vegetables are always weak and dwarfiſh, and their prolific powers are diminiſhed. They may alſo be poiſoned by the abſorption of fluids hoſtile to their conſtitution. Beſide theſe general affections, common to the plant and animal, vegetables are injured, and often killed, by particular diſeaſes.

Some diſeaſes attack the leaves only, and produce ſpots of various colours, rugoſities, puſtules, galls, &c. Others are peculiar to the flowers and fruit, and often occaſion barrenneſs for a ſeaſon; and ſometimes this ſterility continues during the exiſtence of the plant. Others aſſault the viſcera, or internal organs, and give riſe to obſtructions, tumors, and a gradual reſolution and corruption of the whole fabrick. Many of the diſeaſes of plants are produced by the inſect tribes. Their wounds and depredations are not confined to particular parts, but extend from the root to the ſtem, branches, leaves, flowers, and fruit. Inſects not only injure the ſubſtance of plants, but, by feeding on their juices, deprive them of a part of their nouriſhment, and occaſion various diſeaſes or changes in their organization. Other diſeaſes of plants derive their origin from change of climate, from miaſmata or noxious vapours in the atmoſphere, and from improper culture. When wounded by external injuries, vegetables diſcharge their blood in copious ſtreams. If the wound be not mortal, the fibres on all ſides gradually ſhoot out, and cloſe the fracture by a callous ſubſtance.

From this general enumeration, it is obvious, that the diſeaſes of plants are not only ſimilar to thoſe of animals, but proceed from the ſame cauſes. In both kingdoms, ſome diſeaſes are only partial or ſuperficial, and are cured either by Nature, or by the aſſiſtance of art. Others are mortal, and ſucceeded by a total putrefaction or decompoſition of the individual.

But, though plants ſhould eſcape the numberleſs diſeaſes which daily threaten them, they have no defence againſt the ſlower approaches of old age, and its unavoidable conſequence, death. In progreſs of time, the veſſels gradually harden and loſe their tone. The juices no longer move with equal celerity as in youth. They are not abſorbed with the ſame preciſion. They at laſt ſtagnate and corrupt. This corruption is ſoon communicated to the veſſels in which the juices are contained, and produces a total ceſſation of all the vital functions.

The life of animals is diverſified by a number of ſucceſſive changes. Infancy, youth, manhood, old age, are characteriſed by imbecillity, beauty, fertility, dotage. All theſe viciſſitudes are conſpicuous in the vegetable world. Weak and tender in infancy, beautiful and vigorous in youth, robuſt and fruitful in manhood, and, when old age approaches, the head droops, the ſprings of life dry up, and the tottering vegetable, like the animal, returns to that duſt from which it ſprung.

Upon the whole, by taking a retroſpective view of the extreme difficulty of aſcertaining the boundaries which diſtinguiſh the animal from the vegetable, and of the ſimilarities in their ſtructure and organs, in their growth and nouriſhment, in their diſſemination and decay, it is apparent, that both theſe kingdoms conſtitute the ſame order of beings, and that Nature, in the formation of them, has operated upon one great and common model.

CHAPTER II.

Of the organs and general ſtructure of Animals—A ſhort view of the external and internal parts of the human body—This ſtructure compared with thoſe of Quadrupeds, Birds, Fiſhes, and Inſects—How far peculiarities of ſtructure are connected with peculiarities of manners and diſpoſitions.

IN Treating of this ſubject, it is not intended to dive into the depths of anatomical reſearch. On the contrary, I ſhall exhibit ſhort views only of the general ſtructure and organization of the various claſſes of animated beings, from man, who is the moſt perfect animal of which we have any knowledge, down to the inſect tribes. Conſidering man, therefore, as the ſtandard of animal perfection, we ſhall inſtitute frequent compariſons, and mark peculiar diſtinctions between him and the brute creation, both with regard to form, manners, and ſagacity. By following this plan, I hope I ſhall be enabled to render a ſubject which, at firſt ſight, may have a forbidding aſpect, both intereſting and agreeable.

STRUCTURE OF MAN.

The bones may be regarded as the baſis upon which the human body is conſtructed. The ſpine, or back-bone, conſiſts of a number of vertebrae, or ſmall bones, connected together by cartilages, articulations,

culations, and ligaments. In the centre of each vertebra there is a foramen, or hole, for the lodgement and continuation of the ſpinal marrow, which extends from the brain to the rump. From theſe vertebrae the arched bones called ribs proceed; and ſeven of them join the breaſt-bone on each ſide, where they terminate in cartilages, and form the cavity of the thorax, or cheſt. This cavity contains the heart and lungs; and the oeſophagus, or gullet, paſſes through it to reach the ſtomach. The five lower ribs, with a number of muſcles, form another cavity termed the *abdomen*, or belly, in which are contained the ſtomach, the bowels, the *omentum*, or cawl, the liver, the gall-bladder, the ſpleen, the pancreas, and the kidneys. The cheſt and abdomen are ſeparated from each other by the diaphragm, or midriff. The lower part of this laſt cavity contains the bladder of urine, and the rectum, or termination of the inteſtines. Beſide theſe, in females, the pelvis includes the uterus and its appendages. This part of the cavity is formed by the os ſacrum, or termination of the back-bone, and the two oſſa innominata.

The bones of the cranium and face are very numerous. They are connected together by means of ſutures, articulations, and membranes. The bones of the cranium include the brain, and its two membranous coverings, called the *pia* and *dura mater*, and the medulla oblongata, of which laſt the ſpinal marrow is a prolongation. The bones of the upper and under jaw form another cavity for the reception of the tongue and organs of ſpeech.

The only remaining bones are thoſe of the upper and lower extremities. The ſhoulder and collar bones articulate with the top of the arm and the breaſt-bone. The arm-bone, or *os humeri*, is joined to the two bones of the fore-arm, called *ulna* and *radius*, and theſe laſt to the bones of the *carpus*, or wriſt, by means of articulations and firm membranes. To the bones of the wriſt, thoſe of the metacarpus and fingers are attached in a ſimilar manner.

With regard to the lower extremities, the thigh-bone articulates above with the hip-bone, and below with the leg-bone and the rotula, or knee-pan. The leg, like the fore-arm, is compoſed of two bones, the tibia and fibula, which articulate with each other, and with the tarſal, or heel-bones of the foot; and to theſe laſt the metatarſal bones, and thoſe of the toes, are joined.

From this outline, ſome idea may be formed of the human ſkeleton. The other parts of which our bodies are compoſed ſhall be mentioned in the ſame curſory manner.

The muſcular part of the human fabric conſiſts of numerous bundles of fleſhy fibres. Each bundle, or diſtinct muſcle, is incloſed in a cellular membrane, by which means they may be raiſed, or ſeparated from one another by the hand of the anatomiſt. They are inſerted, by ſtrong tendinous extremities, into the different bones of which the ſkeleton is compoſed, and, by their contraction and diſtention, give riſe to all the movements of the body. The muſcles, therefore, may be conſidered as ſo many cords attached to the bones; and Nature has fixed them according to the moſt perfect principles of mechaniſm, ſo as to produce the fitteſt motions in the bones or parts for the movement of which they are intended.

The heart is a hollow muſcular organ of a conical ſhape, and conſiſts of four diſtinct cavities. The two largeſt are called *ventricles*, and the two ſmalleſt *auricles*. The heart is incloſed in the *pericardium*, a membranous bag, which likewiſe contains a quantity of water, or lymph. This water lubricates the heart, and facilitates all its motions. The heart is the general reſervoir of the blood. By the contractions and dilatations of this muſcle, the blood is alternately thrown out of, and received into, its ſeveral cavities. When the heart contracts, the blood is propelled from the right ventricle into the lungs through the pulmonary arteries, which, like all the other arteries, are furniſhed with valves that play eaſily forward, but admit not the blood to regurgitate toward the heart. The blood, after circulating through the lungs, returns into the left ventricle of the heart by the pulmonary vein. At the ſame inſtant, the left ventricle drives the blood into the aorta, a large artery which ſends off branches to ſupply the head and arms. Another large branch of the aorta deſcends along the inſide of the back-bone, and detaches numerous ramifications to nouriſh the viſcera and inferior extremities. After ſerving the moſt remote extremities of the body, the arteries are converted into veins, which, in their return toward the heart, gradually unite into larger branches, till the whole terminate in one great trunk called the *vena cava*, which diſcharges itſelf into the right ventricle of the heart, and completes the circulation.

Beſide the heart, the thorax or cheſt contains the lungs, or organs of reſpiration. They are divided into five lobes, three of which lie on the right, and two on the left ſide of the thorax. The ſubſtance of the lungs is chiefly compoſed of infinite ramifications of the trachea or windpipe, which, after gradually becoming more and more minute, terminate in little cells or veſicles, which have a free communication with one another. At each inſpiration, theſe pipes and cells are filled with air, which is again diſcharged by reſpiration. In this manner, a circulation of air, which is neceſſary to the exiſtence of men and other animals, is conſtantly kept up as long as life remains.

The inſtruments and proceſs of digeſtion fall next to be conſidered. The ſtomach is a membranous and muſcular bag furniſhed with two orifices: By the one it has a communication with the *oeſophagus*, or gullet, and by the other with the bowels, which begin at the ſtomach and terminate at the anus. In the ſtomach and inteſtines there are immenſe numbers of minute veſſels called *lacteals*, the mouths of which are conſtantly open for the reception of the nutritious particles. After being moiſtened and lubricated by the ſaliva, the food is received into the ſtomach, where it is ſtill farther diluted by the gaſtric juice, which has the power of diſſolving every kind of animal and vegetable ſubſtance. When the food has remained ſome time in the ſtomach, it is reduced to a grayiſh pulp, mixed with ſome chylous or milky particles. The thinner and more perfectly digeſted parts of the food gradually paſs through the *pylorus*, or lower aperture of the ſtomach, into the inteſtines, where they are ſtill farther attenuated and digeſted by the bile and pancreatic juices. While the food is in this fluid ſtate, it receives the denomination of *chyle*, and is continually abſorbed by the mouths of the lacteal veins. Theſe veſſels ariſe, like net-work, from the inner ſurface of the inteſtines, paſs obliquely through their coats, and, running along the meſentery, unite, as they advance, into larger branches, and at laſt terminate in the thoracic duct, or general receptacle of the chyle. Beſide the lacteals, there is another ſyſtem of veſſels called *lymphatic*, or abſorbent veins: They are minute pellucid tubes, and generally lie cloſe to the large blood-veſſels. The lymphatics from all the lower parts of the body gradually unite as they approach the thoracic duct, into which they pour a colourleſs fluid by three or four large trunks; and the lymphatics from all the ſuperior parts of the body likewiſe diſcharge their lymph into the ſame duct as it runs upward to terminate in the left ſubclavian vein. By this curious and beautiful machinery, the chyle and lymph, which conſiſt of the nutritious matters extracted from the food, enter the circulating ſyſtem, are converted into blood, and afford that conſtant ſupply of nouriſhment which the perpetual waſte of our bodies demands.

We ſhall next give a ſketch of thoſe important organs by which we are enabled to multiply and continue the ſpecies. The circulation of the blood, and the mode by which the quantity of it is continually kept up by freſh ſupplies of chyle, are effects which, in ſome meaſure, correſpond with our ideas of the machinery employed. The organs of generation exhibit a ſtill more complex ſpecimen of exquiſite mechaniſm. But the machinery employed, without the aid of experience, could never ſuggeſt the moſt diſtant idea of the effect to be produced.

In the male, the organs of generation conſiſt of the teſtes, the ſeminal veſſels, and the penis. The teſtes are two glandular bodies which poſſeſs the power of converting the blood into ſemen. They are originally formed and lodged in the abdomen; and it is not till after birth that they commonly paſs into the groin, and from thence fall into the ſcrotum, which is a muſcular bag prepared for their reception and defence. The teſtes of the hedgehog and of ſome other quadrupeds remain in the abdomen during life. Inſtances of the ſame kind ſometimes happen in the human ſpecies. Each teſticle is compoſed of the ſpermatic artery and vein. The blood paſſes very ſlowly through the ſpermatic artery, and produces an infinite number of convolutions in the ſubſtance of the teſticle, where it depoſits the ſemen, which is taken up by the ſemeniferous tubes. Theſe tubes at length unite, and, by an immenſe number of circumvolutions, form a kind of appendix to the teſticle, commonly known by the term *epidydymis*. The tubes of the epidydymis, after terminating in an excretory duct called *vas deferens*, aſcend toward the abdominal rings, and depoſit the ſemen in the ſeminal veſicles, which are two ſoft convoluted bodies ſituated between the rectum and bladder, and unite at their lower extremity: From theſe reſervoirs the ſemen is occaſionally diſcharged through the ſhort canals which open into the urethra. The penis is a cavernous and ſpungy ſubſtance perforated longitudinally by a canal called the *urethra*, which, by communicating with the bladder and ſeminal veſſels, anſwers the double purpoſe of diſcharging both the urine and ſemen.

With regard to the female organs, the uterus and its appendages merit a principal attention. The uterus is a hollow muſcular body ſituated between the rectum and bladder, and, when not in an impregnated ſtate, reſembles a pear, with the thickeſt end turned toward the abdomen. The entrance into the cavity of the uterus forms a ſmall protuberance, which has been compared to the mouth of a tench, and from this circumſtance it has received the name of *os tincae*. The uterus is connected to the ſides of the pelvis by two broad ligaments, which ſupport it in the vagina in a pendulous ſituation. From each ſide of the bottom of the uterus the two Fallopian tubes ariſe, paſs through the ſubſtance of the uterus, and extend along the broad ligaments till they reach the edge of the pelvis; from whence they are reflected backward, and turning over behind the ligaments, their extremities hang looſe in the pelvis. Theſe extremities, becauſe they have a ragged appearance, are called *fimbriae*, or *morſus diaboli*: Each Fallopian tube is about three inches long. Their cavities are at firſt very ſmall, but become gradually larger, like a trumpet, as they approach the fimbriae. Near the fimbriae of each tube, about an inch from the uterus, are ſituated the ovaria, or two oval bodies, about half the ſize of the male teſticle. They are covered with a production of the peritoneum, and hang looſe in the pelvis. In their ſubſtance there are ſeveral minute veſicles filled with lymph. The number of theſe veſicles ſeldom exceeds twelve in each ovarium. In mature females, theſe veſicles become exceedingly turgid; and a yellow coagulum gradually forms in one of them, which increaſes till its coat diſappears. It then changes into a hemiſpherical body called *corpus luteum*, which is deſcribed as being hollow and containing within its cavity very minute eggs, each of which, it is ſuppoſed, may be impregnated, and produce a foetus. After impregnation, one of theſe eggs, as we are informed by anatomiſts, is abſorbed by and paſſes through the Fallopian tube into the uterus, where it is nouriſhed till mature for birth.

We ſhall conclude this ſubject with a conciſe account of the inſtruments of ſenſation. The organs hitherto deſcribed convey nothing more than the idea of an automaton, or ſelf-moving machine. But ſenſation, or the perception of pleaſure and pain, is effected by organs of a peculiar kind. Theſe organs are all comprehended under the general appellations of the *brain* and *nerves*.

Beſide the bones of the cranium, the brain is inveſted with two membranes, called *dura* and *pia mater*, becauſe they were ſuppoſed by the Arabians to be the ſource of all the other membranes of the body. Under the denomination of *brain* are comprehended three diſtinct parts, the *cerebrum*, the *cerebellum*, and *medulla oblongata*. The *cerebrum* is a ſoft medullary maſs, ſituated in the anterior part of the ſkull, and divided, by a portion of the dura mater, into two hemiſpheres. It conſiſts of two ſubſtances, the cortical, which is greyiſh, and the medullary, which is ſofter, and of a very white colour. The *cerebellum* is divided into two lobes, and its ſubſtance is firmer and more compact than that of the cerebrum. It is likewiſe compoſed of the cortical and medullary ſubſtances. The reunion of the medullary ſubſtances of the cerebrum and cerebellum, at the baſis of the ſkull, forms the *medulla oblongata*, of which the ſpinal marrow is a continuation. The brain of the human ſpecies is proportionally much larger than that of quadrupeds.

The brain and ſpinal marrow are ſuppoſed to be the origin of all the nerves or inſtruments of ſenſation. The nerves are, in general, cineritious, ſhining, inelaſtic cords. But they differ from each other in ſize, colour, and conſiſtence. From numberleſs experiments and obſervations, it is unqueſtionable, that the nerves are the inſtruments both of ſenſation and of animal motion. But, how theſe effects are produced by the nervous influence is a diſcovery ſtill to be made. The inquiry, however, has given riſe to ſeveral ingenious conjectures and hypotheſes. Some phyſiologiſts have maintained, that the nerves are ſolid cords, which may be divided into an infinite number of minute filaments; and that, by the vibrations of theſe cords, the various impreſſions and modifications of feeling are conveyed to the brain. Others, with more plauſibility, have ſuppoſed, that the nerves are aſſemblages of ſmall tubes; that a ſubtile fluid, ſometimes called *animal ſpirits*, is ſecreted in the brain and ſpinal marrow; and that by the influence or motions of this fluid all the ſenſations of animals are tranſmitted to the ſenſorium, or general repoſitory of ideas. But it is needleſs to dwell upon a ſubject covered with darkneſs, and which all the efforts of human powers will probably never bring to light.

Anatomiſts have deſcribed forty pair of nerves. Ten of them proceed from the medulla oblongata of the brain, and thirty from the ſpinal marrow. Theſe nerves, by ſending off innumerable ramifications, are diſtributed, like a net-work, over every part of the body, till they terminate, in the form of minute papillae, upon the ſkin. That the nerves are the immediate inſtruments of ſenſation, as well as of muſcular motion, has been proved by a thouſand uncontrovertible experiments. When the trunk of the ſciatic nerve is cut, the thigh and leg on that ſide inſtantly loſe all motion, and all ſenſe of pain, below the inciſion, and neither time nor art can ever reſtore the power of feeling or of moving. But the parts between the inciſion and the ſpinal marrow, which is a continuation of the brain, retain their uſual degrees both of motion and of ſenſation. From this experiment, it is evident, that the nerves are the organs by which ſenſation and motion are effected, and that, for theſe important purpoſes, an uninterrupted connection between any particular nerve and the brain, or ſpinal marrow, is indiſpenſible.

This ſketch of the human fabric requires an apology to anatomical readers, who muſt be ſenſible of its many imperfections. To perſons who have not ſtudied that curious and uſeful ſcience, I imagined a general view of the ſtructure of man, if properly compoſed, might enable them to acquire more diſtinct ideas of the many ſeeming deviations from the common plan obſerved by Nature in the formation of the inferior and more imperfect animals.

OF THE STRUCTURE OF QUADRUPEDS.

Having delineated the ſtructure and organs of the human ſpecies, it is worthy of remark, that the intellect, or ſagacity, of inferior animals augments or diminiſhes in proportion as the formation of their bodies approaches to, or recedes from, that of man. Quadrupeds, accordingly, are more intelligent than birds; the ſagacity of birds exceeds that of fiſhes; and the dexterity and cunning of fiſhes are ſuperior to thoſe of moſt of the inſect tribes. The ſame gradation of mental powers is exhibited in different ſpecies of the ſame claſſes of animals. The form of the orang outang makes the neareſt approach to the human; and the arts he employs for his defence, the actions he performs, and the ſagacity he diſcovers, are ſo aſtoniſhing, that ſome philoſophers have conſidered him as a real human being in the moſt debaſed ſtage of ſociety. Next to the orang outang, the organs of the different ſpecies of apes and monkeys have the greateſt reſemblance to thoſe of man; and their powers of imitation, their addreſs in procuring their food, and in managing their young, their ingenuity, and their ſagacious manners, have contributed to the amuſement, and excited the admiration, of mankind in all ages and nations. The ſame relation between form and intellect may be traced in the dog, the cat, the ſow, the horſe, the ſheep, and the other ſpecies of quadrupeds.

With regard to the general ſtructure and figure of quadrupeds, a great variety is exhibited in the different kinds. But, when examined in detail, it is apparent, that they, as well as man, are all formed upon one primitive and general deſign. Beſide the organs of ſenſation, of circulation, of digeſtion, and of generation, without which moſt animals could neither ſubſiſt nor multiply, there is, even among thoſe parts that chiefly contribute to variety in external form, ſuch a wonderful reſemblance as neceſſarily conveys the idea of an original plan upon which the whole has been executed. For example, when the parts conſtituting a horſe are compared with the human frame, inſtead of being ſtruck with their difference, we are aſtoniſhed at their ſingular and almoſt perfect reſemblance. Take the ſkeleton of a man, ſays Buffon, incline the bones of the pelvis; ſhorten thoſe of the thighs, legs, and arms; join the phalanges of the fingers and toes; lengthen the jaws by ſhortening the frontal bones; and, laſtly, extend the ſpine of the back. This ſkeleton would no longer repreſent that of a man: It would be the ſkeleton of a horſe. For, by lengthening the back-bone and the jaws, the number of the vertebrae, ribs, and teeth, would be increaſed; and it is only by the number of theſe bones, and by the prolongation, contraction, and junction of others, that the ſkeleton of a horſe differs from that of a man. The ribs, which are eſſential to the figure of animals, are found equally in man, in quadrupeds, in birds, in fiſhes, and even in the turtle. The foot of the horſe, ſo apparently different from the hand of a man, is compoſed of ſimilar bones; and, at the extremity of each finger, we have the ſame ſmall bone, reſembling the ſhoe of a horſe, which bounds the foot of that animal. Raiſe the ſkeletons of quadrupeds, from the ape-kind to the mouſe, upon their hind-legs, and compare them with the ſkeleton of a man, the mind will be inſtantly ſtruck with the uniformity of ſtructure and deſign obſerved in the formation of the whole group. This uniformity is ſo conſtant, and the gradations from one ſpecies to another are ſo imperceptible, that to diſcover the marks of their diſcrimination requires the moſt minute attention. Even the bones of the tail will make but a ſlight impreſſion on the obſerver. The tail is only a prolongation of the *os coccygis*, or rump-bone, which is ſhort in man. The orang outang, and true apes, have no tail; and, in the baboons, and ſeveral other quadrupeds, the tail is exceedingly ſhort. Thus, in the creation of animals, the Supreme Being ſeems to have employed only one great idea, and, at the ſame time, to have diverſified it in every poſſible manner, that men might have an opportunity of admiring equally the magnificence of the execution and the ſimplicity of the deſign.

In quadrupeds, as well as in man, the bones are connected by articulations and membranes; and the different movements of theſe bones are performed by the operation of muſcles. The number, diſpoſition, and form of the muſcles, with a few exceptions ariſing from the figure and deſtination of parts peculiar to particular animals, are nearly the ſame in men and in quadrupeds. The circulation of their blood, the ſecretion of their fluids, and the proceſs of digeſtion, are carried on by organs perfectly ſimilar to thoſe of the human body. In the external covering, a ſmall difference takes place. Quadrupeds are furniſhed with a thick covering of hair, or wool, to defend them from the injuries of the weather. Being deſtitute of art ſufficient to make garments, Nature has ſupplied that defect, by giving them a coat of hair, which varies in thickneſs according to the ſeaſon of the year and the difference of climate. In Ruſſia, Lapland, Kamtſchatka, and all the northern regions, the furs of animals are very thick and warm. But, in Turkey, Africa, and the ſouthern parts of Aſia and America, moſt quadrupeds are thinly clad, and ſome of them, as the Turkiſh dog, are totally deſtitute of hair.

The ſkin of quadrupeds is diſpoſed nearly in the ſame manner as the human, only it is more elaſtic. Immediately under the ſkin, there is a thin muſcular ſubſtance, called *panniculus carnoſus*, which is common to all quadrupeds, except the hog and armadillo kinds. This ſubſtance, which is peculiar to quadrupeds, chiefly covers the trunk, and, by ſuddenly ſhaking and ſhrivelling the ſkin, enables theſe animals to drive off inſects, or other offenſive bodies.

The ſubſtance of the nerves, or organs of ſenſation, is the ſame in the quadruped and in man. They originate from the brain and ſpinal marrow, and are diſtributed over all the internal and external parts of the body, in the ſame manner as in the human frame.

Thus it appears, that, in general ſtructure and organization, the brute creation is nearly allied to the human ſpecies. Some differences, however, merit attention; becauſe a ſlight variation in ſtructure, eſpecially of the internal organs, is often accompanied with great diverſities in diſpoſitions, food, and manners.

Some animals feed upon fleſh, others upon vegetables, and others upon a mixture of both. The diſpoſitions of ſome ſpecies are fierce; and their manners convey to us the ideas of cruelty and of barbariſm: The diſpoſitions and manners of other ſpecies are ſoft and placid, and excite in us ideas of mildneſs, complacency, and innocence. The ferocity of the tyger and hyaena forms a perfect contraſt to the gentleneſs and inoffenſive behaviour of the ſheep and the ox. This oppoſition of manners has given riſe to the diſtinction of animals into rapacious and mild, carnivorous and herbivorous. In the ſtructure of theſe animals, whoſe characters are ſo oppoſite, ſome differences have been diſcovered, which indicate the intentions of Nature in forming them, and fully juſtify the ſeeming cruelty of their conduct.

In all the carnivorous tribes, the ſtomach is proportionally ſmaller, and the inteſtines ſhorter, than in thoſe animals which feed upon vegetables. As animals of the former kind live ſolely on fleſh, the ſhortneſs and narrowneſs of their inteſtines are accommodated to the nature of their food. Animal food is more eaſily reduced to chyle, and becomes ſooner putrid, than vegetable. Of courſe, if its juices were allowed to remain long in the inteſtines, inſtead of nouriſhing the body, they would produce the moſt fatal diſtempers. Beſide this accommodation of the inteſtines to the nature of their food, carnivorous animals are furniſhed with the neceſſary inſtruments for ſeizing and devouring their prey. Their heads are roundiſh, their jaws ſtrong, and their tuſks very long and ſharp. Some of them, as the lion, the tyger, and the whole cat-kind, are provided with long retractile claws. Thus both the internal and external ſtructure of this claſs of animals indicate their deſtination and manners. The rapid digeſtion of their food is a conſequence of the ſtrength and ſhortneſs of their inteſtines ; and the intolerable cravings of their appetite neceſſarily create a fierceneſs and rapacity of diſpoſition. Nothing leſs than blood can ſatiate them. Their cruelty, and the devaſtation they make among the weaker and more timid tribes, are effects reſulting ſolely from the ſtructure and organs with which Nature has thought proper to endow them. Hence, if there be any thing reprehenſible in the manners and diſpoſitions of carnivorous animals, Nature alone is to blame; for all their actions are determined by the irreſiſtible impulſes of their organization. But, even in this ſeemingly cruel arrangement, Nature muſt not be raſhly accuſed. When we come to treat of the hoſtilities of animals, I hope to be able to ſhow, that Nature, in the formation of rapacious creatures, has acted with her uſual wiſdom, and that beings of this kind have their uſes in the general ſyſtem and oeconomy of the univerſe.

As to the herbivorous tribes, or thoſe animals which feed upon grain and herbage, a ſlight variation of organs produces the greateſt effects upon their diſpoſition and manners. The inteſtines of this tribe are very long, capacious, and convoluted. Vegetable food, eſpecially herbage, contains a ſmaller quantity of nutritive matter than the fleſh of animals; neither is it ſo eaſily reduced to chyle. A larger quantity, therefore, as well as a longer detention in the ſtomach and inteſtines, is neceſſary for the nouriſhment of theſe creatures. Several quadrupeds comprehended under this order ruminate or chew the cud. Theſe are furniſhed with no leſs than four ſtomachs. The food, after maſtication, is thrown into the firſt ſtomach, where it remains ſome time; after which, the animal forces it up again into the mouth, and gives it a ſecond chewing. It is then ſent directly into the ſecond ſtomach, and gradually paſſes into the third and fourth; and, laſtly, it is tranſmitted through the convolutions of the inteſtines, and the dregs, or faeces, are thrown out of the body. By this machinery, herbivorous animals are enabled to devour large quantities of vegetable aliment, to retain it long in their bowels, and conſequently to extract from it nutritive matter ſufficient for their growth, ſupport, and multiplication. Here the quantity compenſates the quality of the nutriment.

It is true, that the horſe, the aſs, the hare, and ſome other animals which live upon herbage and grain, have only one ſtomach. But, though the horſe and aſs have one ſtomach only, their inteſtines are furniſhed with ſacs or pouches ſo large, that they may be compared to the paunch of ruminating animals; and hares, rabbits, the Guiney-pig, &c. have blind guts ſo long and capacious, that they are equivalent to a ſecond ſtomach. The hedgehog, the wild boar, the ſquirrel, &c. whoſe ſtomach and inteſtines are of a mean capacity, eat little herbage, but live chiefly upon ſeeds, fruits, and roots, which contain, in ſmall bounds, a greater quantity of nutritive matter than the leaves or ſtems of plants.

The external form of herbivorous animals, like that of the rapacious, is accommodated to their diſpoſitions and the oeconomy they are obliged to obſerve. That they might be enabled to reach the ſurface of the earth with eaſe, the legs of the larger kinds are proportionally ſhort; their head and neck long; and the muſcles and tendons of the neck are endowed with prodigious ſtrength. Without theſe peculiarities of ſtructure, they could not ſupport the prone poſture of the head in the tedious operation of browſing large quantities of herbage. The arrangement and form of their teeth likewiſe indicate the deſtination of the ruminating tribes. They have no cutting teeth in the upper jaw; and they are totally deprived of tuſks, or canine teeth. This laſt circumſtance, joined to their want of claws, ſhews that they are not intended to prey upon other animals. Horns are the only weapons of defence with which they are provided. From the nature of their food, therefore, and the internal and external configuration of their bodies, it is evident, that animals of this deſcription muſt be humble in their deportment and mild in their diſpoſition. This order of animals, accordingly, have uniformly been celebrated for gentleneſs of manners, ſubmiſſion, and timidity. Man has availed himſelf of thoſe diſpoſitions, by reducing almoſt the whole of this tribe to a domeſtic ſtate. But, in all this graciouſneſs of aſpect and tractability of temper, the animals themſelves have no merit. Their motions and actions are neceſſary reſults of the organs which Nature has beſtowed on them. It is obvious, therefore, that the diverſity of taſtes and diſpoſitions exhibited by different animals, ariſes not ſolely from any ſuperior agreeableneſs of particular kinds of food to their palates, or to a peculiar bias of their minds to benevolence and peace, but from a phyſical cauſe depending on the ſtructure of their bodies.

From what has been advanced, it follows, that man, whoſe ſtomach and inteſtines are proportionally of no great capacity, could not live upon herbage alone. It is an inconteſtible fact, however, that he can live tolerably well upon bread, herbs, and the fruits, roots, and ſeeds of plants; for we know whole nations, as well as particular orders of men, who are prohibited by their religion from eating any animal ſubſtance. But theſe examples are not ſufficient to convince us, that the health, vigour, and multiplication of mankind would be improved by feeding ſolely upon pot-herbs and bread. Beſides, his ſtomach and inteſtines are of a mean capacity between thoſe of the carnivorous and herbivorous animals. From this circumſtance alone we are warranted to conclude, that Nature intended him to feed partly on animal and partly on vegetable ſubſtances: And daily experience teaches us, that men fed in this manner are larger, ſtronger, and more prolific, than thoſe who are confined to a vegetable diet. If man had no other ſources of ſuperiority over the other animals than thoſe which originate from the ſtructure of his body, his diſpoſitions ought to be a medium between thoſe of the carnivorous and herbivorous tribes. When conſidered merely as an animal, this appears to be really the caſe. Vulgar and uninformed men, when pampered with a variety of animal food, are much more choleric, fierce, and cruel in their tempers than thoſe who live chiefly on vegetables. Animal food heats the blood, and makes it circulate with rapidity. In this ſituation, every object capable of exciting appetite or paſſion operates with redoubled force. The weak mind yields to the impulſe, and gives vent to every ſpecies of outrage which can debaſe human nature.

In the formation of his body, man has ſome advantages over particular animals. But theſe advantages are inconſiderable, and none of them, perhaps, are peculiar to the ſpecies. The ſtructure of all animals is nicely adjuſted to their deſtination, and the ſtation they occupy in the general ſcale of Being. The body of man is erect, and his attitude is ſaid to be that of command. His majeſtic deportment, and the firmneſs of his movements, announce the ſuperiority of his rank. His arms are not mere pillars for the ſupport of his body. His hands tread not the earth; neither do they loſe, by friction and preſſure, that exquiſite delicacy of feeling for which Nature had originally intended them. His arms and hands, on the contrary, are formed for purpoſes of a more noble kind. They are deſtined for executing the commands of his will, for laying hold of bodies, for removing obſtacles, for defending him from injuries, and for ſeizing and retaining objects of pleaſure. The features of this picture are exact delineations; but they are not the excluſive privilege of man. The orang outang walks erect, and he derives equal advantages from his hands and arms as the human ſpecies. Some apes have likewiſe the power of walking erect, with the additional faculty of employing their hands and arms as legs. They can walk, run, or leap, by the inſtrumentality either of two or of four extremities, as their ſituation or neceſſities may require. It is not, therefore, the fabric of man's body that entitles him to claim a ſuperiority over the other animals. The formation of their bodies is adjuſted with equal ſymmetry and perfection to the rank they hold in the general ſyſtem of animation. Many of them excel us in magnitude, almoſt the whole of this tribe to a domeſtic ſtate. But, in all this graciouſneſs of aſpect and tractability of temper, the animals themſelves have no merit. Their motions and actions are neceſſary reſults of the organs which Nature has beſtowed on them. It is obvious, therefore, that the diverſity of taſtes and diſpoſitions exhibited by different animals, ariſes not ſolely from any ſuperior agreeableneſs of particular kinds of food to their palates, or to a peculiar bias of their minds to benevolence and peace, but from a phyſical cauſe depending on the ſtructure of their bodies.

From what has been advanced, it follows, that man, whoſe ſtomach and inteſtines are proportionally of no great capacity, could not live upon herbage alone. It is an inconteſtible fact, however, that he can live tolerably well upon bread, herbs, and the fruits, roots, and ſeeds of plants; for we know whole nations, as well as particular orders of men, who are prohibited by their religion from eating any animal ſubſtance. But theſe examples are not ſufficient to convince us, that the health, vigour, and multiplication of mankind would be improved by feeding ſolely upon pot-herbs and bread. Beſides, his ſtomach and inteſtines are of a mean capacity between thoſe of the carnivorous and herbivorous animals. From this circumſtance alone we are warranted to conclude, that Nature intended him to feed partly on animal and partly on vegetable ſubſtances: And daily experience teaches us, that men fed in this manner are larger, ſtronger, and more prolific, than thoſe who are confined to a vegetable diet. If man had no other ſources of ſuperiority over the other animals than thoſe which originate from the ſtructure of his body, his diſpoſitions ought to be a medium between thoſe of the carnivorous and herbivorous tribes. When conſidered merely as an animal, this appears to be really the caſe. Vulgar and uninformed men, when pampered with a variety of animal food, are much more choleric, fierce, and cruel in their tempers than thoſe who live chiefly on vegetables. Animal food heats the blood, and makes it circulate with rapidity. In this ſituation, every object capable of exciting appetite or paſſion operates with redoubled force. The weak mind yields to the impulſe, and gives vent to every ſpecies of outrage which can debaſe human nature.

In the formation of his body, man has ſome advantages over particular animals. But theſe advantages are inconſiderable, and none of them, perhaps, are peculiar to the ſpecies. The ſtructure of all animals is nicely adjuſted to their deſtination, and the ſtation they occupy in the general ſcale of Being. The body of man is erect, and his attitude is ſaid to be that of command. His majeſtic deportment, and the firmneſs of his movements, announce the ſuperiority of his rank. His arms are not mere pillars for the ſupport of his body. His hands tread not the earth; neither do they loſe, by friction and preſſure, that exquiſite delicacy of feeling for which Nature had originally intended them. His arms and hands, on the contrary, are formed for purpoſes of a more noble kind. They are deſtined for executing the commands of his will, for laying hold of bodies, for removing obſtacles, for defending him from injuries, and for ſeizing and retaining objects of pleaſure. The features of this picture are exact delineations; but they are not the excluſive privilege of man. The orang outang walks erect, and he derives equal advantages from his hands and arms as the human ſpecies. Some apes have likewiſe the power of walking erect, with the additional faculty of employing their hands and arms as legs. They can walk, run, or leap, by the inſtrumentality either of two or of four extremities, as their ſituation or neceſſities may require. It is not, therefore, the fabric of man's body that entitles him to claim a ſuperiority over the other animals. The formation of their bodies is adjuſted with equal ſymmetry and perfection to the rank they hold in the general ſyſtem of animation. Many of them excel us in magnitude,

nitude, ſtrength, ſwiftneſs, and dexterity in particular movements. Their ſenſes are often more acute; they ſeize their prey, or procure herbage, fruits, and ſeeds of trees, with more facility than man, when limited to the powers of his animal nature. Hence the great ſource of man's ſuperiority over the brute creation muſt be derived from his mental faculties alone. Brutes enjoy the ſame inſtincts, the ſame appetites, and the ſame propenſities, as appear in the conſtitution of the human mind. But the inſtincts of brutes, though they are exerted with great certainty and preciſion, are much circumſcribed with regard to extenſion and improvement. Like man, they derive advantages from experience. But the concluſions they draw from this ſource are always feeble and extremely limited. Neither do they poſſeſs the ineſtimable faculty of tranſmitting the knowledge acquired by individuals from generation to generation. By means of their ſenſes, they learn to diſtinguiſh their enemies, or hurtful objects, at a diſtance; and they know how to avoid them. Experience teaches them to diſcriminate objects of pleaſure from thoſe of pain; and they act according to the feelings excited by theſe objects. Some animals can even accommodate their inſtincts to particular circumſtances and ſituations. The feelings of brutes are often more exquiſite than ours. They have ſenſations; but their faculty of comparing them, or of forming ideas, is much circumſcribed. A dog or a monkey can imitate ſome human actions, and are capable of receiving a certain degree of inſtruction. But their progreſs ſoon ſtops: Nature has fixed the boundaries of mental as well as of corporeal powers; and theſe boundaries are as various as the number of diſtinct ſpecies. Our wonder is equally excited by the ſagacity of ſome animals, and by the ſtupidity of others. This gradation of mental faculties originates from the number or paucity of inſtincts beſtowed on particular ſpecies, joined to the greater or ſmaller power of extending or modifying theſe inſtincts by experience and obſervation. Man is endowed with a greater number of inſtincts than any other animal. The ſuperiority of his rank, however, does not proceed from this ſource alone. Man enjoys beyond every other animal the faculty of extending, improving, and modifying the different inſtincts he has received from Nature. It is this faculty which enables him to compare his feelings, to form ideas, and to reaſon concerning both. The bee makes cells, and the beaver conſtructs habitations of clay. The order of their architecture, however, is invariably the ſame. Man likewiſe builds houſes: But he is not forced, by an irreſiſtible inſtinct, to work always on the ſame plan. His habitations, on the contrary, vary with the fancy of the individuals who deſign and conſtruct them.

Upon the whole, the dignity of man's rank depends not upon the ſtructure of his organs. It is from the powers of his intellect alone that he is entitled to claim a ſuperiority over the brute creation. Theſe powers enable him to form ideas, to abſtract, to reaſon, to invent, and to reach all the heights of ſcience and of art.

The remarks formerly made are applicable to quadrupeds in general. But, before concluding this branch of the ſubject, we ſhall point out a few peculiarities in the ſtructure of particular ſpecies.

Beſide the four ſtomachs common to ruminating animals, the camel and dromedary have a fifth bag, which ſerves them as a reſervoir for holding water. This bag is capable of containing a very large quantity of that neceſſary element. When the camel is thirſty, and has occaſion to macerate his dry food in the operation of ruminating, by a ſimple contraction of certain muſcles, he makes part of this water aſcend into his ſtomach, or even as high as the gullet. This ſingular conſtruction enables him to travel ſix, eight, or even twelve days in the ſandy deſarts, without drinking, and to take at once a prodigious quantity of water, which remains in the reſervoir pure and limpid; becauſe neither the humours of the body, nor the juices that promote digeſtion, can have acceſs to it. Beſide this ſingularity of ſtructure, the camel has two large fleſhy bunches on his back, and the dromedary, or ſwift camel, one bunch; and the feet of both are covered with a very tough, but flexible ſubſtance. The conformation of theſe animals enables them to travel with heavy loads through the ſandy deſarts of the Eaſt, where the horſe or the aſs would inevitably periſh; becauſe Nature has not provided them with reſervoirs for holding and preſerving water, which are indiſpenſible in countries where none of that element can be procured but in particular places, that are often diſtant many days journey from each other. When we conſider the ſtructure of the camel and dromedary, we cannot be deceived with regard to their deſtination. The four ſtomachs indicate a vegetable diet, and the ſame docility and gentleneſs of manners which characteriſe the whole ruminating tribes. From the addition of a fifth bag, or reſervoir for the reception and preſervation of water, we ſhould expect to find ſome peculiarity of diſpoſition. In this conjecture we are not deceived. Of all animals which man has ſubjugated, the camel and dromedary are the moſt abject ſlaves. With incredible patience and ſubmiſſion they traverſe the burning ſands of Africa and Arabia, carrying burdens of amazing weight. Inſtead of diſcovering ſymptoms of reluctance, they ſpontaneouſly lie down on their knees till their maſter binds the unmerciful load. Arabia, and ſome parts of Africa, are the drieſt and moſt barren countries in the world. Both the conſtitution and ſtructure of camels are nicely adapted to the ſoil and climate in which they are produced. The Arabians conſider the camel as a gift ſent from heaven, a ſacred animal, without whoſe aſſiſtance they could neither ſubſiſt, traffick, nor travel. The milk of the camel is their common food. They alſo eat its fleſh; and of its hair they make garments. In poſſeſſion of their camels, the Arabs want nothing, and have nothing to fear. In one day they can perform a journey of fifty leagues into the deſert, which cuts off every approach from their enemies. All the armies in the world would periſh in purſuit of a troop of Arabs. An Arab, by the aſſiſtance of his camel, ſurmounts all the difficulties of a country which is neither covered with verdure, nor ſupplied with water. Notwithſtanding the vigilance of his neighbours, and the ſuperiority of their ſtrength, he eludes their purſuit, and carries off, with impunity, all that he ravages from them. When about to undertake a depredatory expedition, an Arab makes his camels carry both his and their own proviſions. When he reaches the confines of the deſert, he robs the firſt paſſengers who come in his way, pillages the ſolitary houſes, loads his camels with the booty, and, if purſued, he accelerates his retreat. On theſe occaſions he diſplays his own talents as well as thoſe of the camels. He mounts one of the fleeteſt, conducts the troop, and obliges them to travel day and night, without almoſt either ſtopping, eating, or drinking; and, in this manner, he often performs a journey of 300 leagues in eight days.

Another order of quadrupeds deſerves our notice. Thoſe which have been diſtinguiſhed by the appellation of amphibious, are capable of remaining a long time under water. They live chiefly upon fiſhes, and, without this faculty of continuing a conſiderable time under water, they would be unable to procure their food. To this tribe belong the ſeal, the walrus, the manati, the ſea-lion, &c. The ſeal and walrus are more nearly allied to land-quadrupeds than to the cetaceous animals; becauſe they have four diſtinct legs, though nothing but the feet project beyond the ſkin. The toes of the feet are all connected by membranes, which enable theſe animals to ſwim in queſt of their prey. They differ from terreſtrial quadrupeds by the ſingular faculty of living with equal eaſe either in air or in water. This peculiarity of oeconomy and manners preſuppoſes the neceſſity of ſome deviation from the general ſtructure of quadrupeds; and Nature has accompliſhed this purpoſe by a very ſimple artifice.

In man, and in all land-quadrupeds, the lungs of the foetus have no motion, and receive no more blood than is requiſite for their growth and nouriſhment. But, immediately after birth, the young animals reſpire, and the whole maſs of blood circulates through their lungs. To carry on the circulation in the foetus ſtate, another paſſage was neceſſary. The blood in the right auricle of the heart, inſtead of paſſing into the pulmonary artery, and, after circulating through the lungs, returning into the left auricle by the pulmonary vein, paſſes directly from the right to the left auricle through an aperture called the *foramen ovale*, which is ſituated in the partition of the heart that ſeparates the cavities of the two auricles. By this contrivance, the maſs of blood, without deviating into the lungs, enters the aorta, and is diſtributed over every part of the body. In man, and the other terreſtrial animals, the foramen ovale of the heart, which permits the foetus to live without reſpiration, cloſes the moment after birth, and remains ſhut during life. Animals of this conſtruction can neither live without air, nor remain long under water, without being ſuffocated.

But, in the ſeal, walrus, and other amphibious animals, the foramen ovale continues open during life, though the mothers bring forth on land, and reſpiration commences immediately after birth. By means of this perpetual aperture in the ſeptum or partition of the heart, which allows a direct communication of the blood from the vena cava to the aorta, theſe animals enjoy the privilege of reſpiring, or not, at their pleaſure.

This ſingularity in the ſtructure of the heart, and the conſequent capacity of living equally on land and in water, muſt neceſſarily produce ſome peculiarities in the manners and diſpoſitions of amphibious animals. The ſeal, accordingly, whoſe hiſtory is beſt known, may be conſidered as holding the empire of the ſilent ocean. To this dignity he is entitled by his voice, his figure, and his intelligence, which render him ſo ſuperior to the fiſhes, that they ſeem to belong to another order of beings. Though his oeconomy be very different from that of our domeſtic animals, he is ſuſceptible of a ſpecies of education. He is reared by putting him frequently in water. He is taught to give a ſalute with his head and his voice. He approaches when called upon. His ſenſes are equally acute as thoſe of any quadruped; and, of courſe, his ſenſations and intellect are equally active. Both are exhibited in the gentleneſs of his manners, his ſocial diſpoſition, his affection for the female, his anxious attention to his offspring, and the expreſſive modulation of his voice. Beſides, he enjoys advantages which are peculiar to him. He is neither afraid of cold nor of heat. He lives indifferently on herbs, fleſh, or fiſh. He inhabits, without inconvenience, water, land, or ice. When aſſiſtance is neceſſary, the ſeals underſtand and mutually aſſiſt one another. The young diſtinguiſh their mother in the midſt of a numerous troop. They know her voice; and, when ſhe calls, they never fail to obey.

Before diſmiſſing this branch of the ſubject, the elephant muſt not be paſſed over in ſilence. His ſtructure is uncommon, and ſo are his talents. The elephant is the largeſt and moſt magnificent animal that at preſent treads the earth. Though he daily devours great quantities of herbage, leaves, and branches of trees, he has but one ſtomach, and does not ruminate. This want, however, is ſupplied by the magnitude and length of his inteſtines, and particularly of the colon, which is two or three feet in diameter by fifteen or twenty in length. In proportion to the ſize of the elephant, his eyes are very ſmall; but they are lively, brilliant, and capable of a pathetic expreſſion of ſentiment. He turns them ſlowly, and with mildneſs, toward his maſter. When he ſpeaks, the animal regards him with an eye of friendſhip and attention. He ſeems to reflect with deliberation, and never determines till he has examined, without paſſion or precipitation, the orders which he is deſired to obey. The dog, whoſe eyes are very expreſſive, is too prompt and vivacious to allow us to diſtinguiſh with eaſe the ſucceſſive ſhades of his ſenſations. But, as the elephant is naturally grave and moderate, we perceive in his eyes the order and ſucceſſion of his thoughts. His ears are very large, and much longer, even in proportion to his body, than thoſe of the aſs. They lie flat on the head, and are commonly pendulous; but he can raiſe and move them with ſuch facility, that he uſes them as a fan to cool himſelf, and to defend his eyes from duſt and inſects. His ear is likewiſe remarkably fine; for he delights in the ſound of muſical inſtruments, and moves in cadence to the trumpet and tabour.

But, in the ſtructure of the elephant, the moſt ſingular organ is his trunk or proboſcis. It is compoſed of membranes, nerves, and muſcles; and it is at once an inſtrument of feeling and of motion. The animal can not only move and bend the trunk, but he can contract, lengthen, and turn it on all ſides. The extremity of the trunk terminates in a protuberance that ſtretches out on the upper ſide in the form of a finger; by means of which he lifts from the ground the ſmalleſt pieces of money; he ſelects herbs and flowers, and picks them up one by one; he unties the knots of ropes, opens and ſhuts gates by turning the keys or puſhing back the bolts. In the middle of this protuberance or finger, there is a cavity in the form of a cup, and, in the bottom of the cup are the apertures of the two organs of ſmelling and reſpiration. This hand of the elephant poſſeſſes ſeveral advantages over that of the human. It is more flexible, and equally dexterous in laying hold of objects. Beſides,

ſides, he has his noſe in his hand, and is enabled to combine the power of his lungs with the action of his finger, and to attract fluids by a ſtrong ſuction, or to raiſe heavy bodies by applying to them the edge of his trunk, and making a vacuum within by a vigorous inſpiration. Hence delicacy of feeling, acuteneſs of ſmelling, facility of movement, and the power of ſuction, are united at the extremity of the elephant's trunk. Of all the inſtruments which Nature has beſtowed on her moſt favourite productions, the trunk of the elephant ſeems to be the moſt complete, as well as the moſt admirable. It is not only an organic inſtrument, but a triple ſenſe, whoſe united functions exhibit the effects of that wonderful ſagacity which exalts the elephant above all other quadrupeds. He is not ſo ſubject, as ſome other animals, to errors of viſion; becauſe he quickly rectifies them by the ſenſe of touch; and, by uſing his trunk as a long arm, for the purpoſe of touching remote objects, he acquires, like man, clear ideas of diſtances. But other animals, except ſuch as have a kind of arms and hands, can only acquire ideas of diſtances by traverſing ſpace with their bodies. Delicacy of feeling, the flexibility of the trunk, the power of ſuction, the ſenſe of ſmelling, and the length of the arm, convey ideas of the ſubſtance of bodies, of their external form, of their weight, of their ſalutary or noxious qualities, and of their diſtances. Thus, by the ſame organs, and by a ſimultaneous act, the elephant feels, perceives, and judges of ſeveral things at one time. It is by virtue of this combination of ſenſes and faculties in the trunk that the elephant is enabled to perform ſo many wonderful actions, notwithſtanding the enormity of his maſs and the diſproportions of his form. The thickneſs and rigidity of his body; the ſhortneſs and ſtiffneſs of his neck; the ſmallneſs of his head; the largeneſs of his ears, noſe, and tuſks; the minuteneſs of his eyes, mouth, genitals, and tail; his ſtraight, clumſy, and almoſt inflexible limbs; the ſhortneſs and ſmallneſs of his feet; the thickneſs and calloſity of his ſkin; all theſe deformities are the more obvious and diſageeable, becauſe they are modelled on a large ſcale, and moſt of them are peculiar to the elephant.

From this ſingular conformation, the animal is ſubjected to many inconveniencies. He moves his head with difficulty, and cannot turn back without making a large circuit. For this reaſon, the hunters attack him behind, or on the flanks, and avoid the effects of his rage by circular movements. He cannot ſeize any object on the ground with his mouth, becauſe his neck is too ſtiff to allow his head to reach the earth. He is therefore obliged to lay hold of his food, and even of his drink, with his noſe, and then convey them to his mouth. It is likewiſe a conſequence of this ſtructure, that the young elephants are ſaid to ſuck with their noſe, and afterwards pour the milk into their gullet.

OF THE STRUCTURE OF BIRDS.

From the figure and movements of the feathered tribes, we ſhould be led to imagine that the ſtructure of their organs was extremely different from that of quadrupeds. Their oeconomy and manner of living required ſome variations in their frame. But thoſe variations are by no means ſo many or ſo great as might be expected. Inſtead of hairs, their bodies are covered with feathers, which, beſide the beautiful variety of their colours, protect this claſs of animals from the aſſaults of rain and cold. They have only a couple of legs; but Nature has furniſhed them with two additional inſtruments of motion, by which they are enabled to riſe from the ſurface of the earth, and to fly with amazing rapidity through the air. The wings are articulated with the breaſt-bone, and their motions are performed by muſcles of remarkable ſtrength. Many birds are continually paſſing through hedges and thickets. To defend their eyes, therefore, from external injuries, as well as from too much light when flying in oppoſition to the rays of the ſun, they are furniſhed with a membrane called *membrana nictitans*, which, like a curtain, can at pleaſure be drawn over the whole eye. This covering is neither opaque nor pellucid; but, being ſomewhat tranſparent, it allows as many rays to enter as render any object juſt viſible, and enable them to direct their progreſs through the air. It is by the inſtrumentality of this membrane that the eagle looks at the ſun. The feathers of all birds are inſerted into the ſkin in ſuch a manner that they naturally lie backward from the head; and allow the rain to run off their bodies, and, by turning their heads in oppoſition to the wind, prevent the wind from rumpling their feathers and retarding their flight. Beſide this proviſion, the rump of birds terminates in a large gland, which ſecretes an oily ſubſtance. When the feathers are too dry, or any way diſordered, the animals ſqueeze this gland with their bills, extract the oil, and with it they beſmear and dreſs the feathers. By this means the admiſſion of water is totally prevented. Birds have no ſeparate ribs; but the breaſt-bone, which is very large, joins the back-bone, and ſupplies their place.

With regard to the external figure of birds, the form of their bodies is nicely adapted to their manners and the mode of life they are deſtined to purſue. By ſtriking the air with their wings, they move forward in that element, and their tail ſerves them as a rudder to direct their courſe. Their breaſt-bone, inſtead of being flat, riſes gradually from the ſpine and terminates in a ſharp ridge or keel, which enables them to cut the air with greater facility. For the ſame purpoſe, the heads of birds are proportionally ſmaller than thoſe of quadrupeds, and moſt of them terminate in light ſharp-pointed beaks. They are likewiſe deprived of external ears, and of protuberant noſtrils. Their tails, inſtead of vertebrae, muſcles, and ſkin, conſiſt entirely of feathers. They have no pendulous ſcrotum, no bladder, no fleſhy uterus. Neither have they an epiglottis, though many of them poſſeſs great powers of modulation, and ſome of them may even be taught to articulate words. To lighten their beaks, they are deprived of lips and teeth; and their abdomen or belly is proportionally ſmall and narrow.

From this general view of the external figure and ſtructure of birds, it is apparent, that Nature has deſigned them for two diſtinct kinds of motion. They can, at pleaſure, either walk on the ſurface of the earth, or mount aloft, and penetrate the airy regions with prodigious ſwiftneſs.

Some peculiarities in the internal ſtructure of birds deſerve our notice.

Like quadrupeds, the feathered tribes are divided into granivorous and carnivorous; and their manners and diſpoſitions correſpond with their internal and external conformation.

In the granivorous claſs, the oeſophagus or gullet runs down the neck, and terminates in a pretty large membranous ſac, called the *ingluvies*, or craw, where the food is macerated, and partly diſſolved by a liquor ſecreted from glands ſpread over the ſurface of this ſac. Some birds, as the rooks and the pigeon kind, have the power of bringing up the food from this ſac into their mouths, and feeding their young with it in a half digeſted form. After macerating for ſome time, the food paſſes through the remainder of the gullet into another ſpecies of ſtomach denominated *ventriculus ſuccenturiatus*, which is a continuation of the gullet. Here the food receives a farther dilution. From this ſecond ſtomach, the food is tranſmitted to the gizzard, or true ſtomach, which conſiſts of two very ſtrong muſcles, covered externally with a tendinous ſubſtance, and lined with a thick, firm membrane. The remarkable ſtrength of the gizzard was formerly ſuppoſed to aſſiſt the digeſtion of granivorous birds by attrition. But this notion has of late been entirely exploded; for Doctor Stevens, and, after him, Spalanzani, have demonſtrated, by unequivocal experiments, that digeſtion is performed ſolely by the diſſolving powers of the gaſtric juices *. The other inteſtines are proportionally larger, and much longer than thoſe of the carnivorous birds.

The ſtructure of the heart, in granivorous birds, is nearly the ſame with that of quadrupeds.

The lungs hang not looſe in the cavity of the thorax, but are fixed to the back-bone: Neither are they divided into lobes, as in man and other animals whoſe ſpines admit of conſiderable motion. They are red, ſpongy bodies, covered with a membrane that is pervious, and communicates with the large veſicles or air-bags which are ſpread over the whole abdomen. Theſe veſicles, when diſtended with air, render the bodies of birds ſpecifically light. They likewiſe ſupply the place of a diaphragm, and ſtrong abdominal muſcles. They produce the ſame effects on the viſcera as theſe muſcles would have done, without the inconveniency of giving an additional weight to the body.

Birds have no bladder of urine: But a blueiſh-coloured canal, or ureter, is ſent off from each kidney, and terminates in the rectum. Their urine is diſcharged along with the faeces. It is a whitiſh ſubſtance, and turns chalky when expoſed to the air.

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* See Steven's Diſſert. Med. Inaug. De Alimentorum Concoctione, Edin. 1777, and Spalanzani.

The teſticles of the male are ſituated on each ſide of the back-bone, and are very large in proportion to the ſize of the animal. From the teſticles proceed two ſeminal ducts, which at firſt are ſtraight, but afterwards acquire a convoluted form, as in the epidydymus of man. Theſe ducts terminate in the penis, of which the cock has two, one on each ſide of the common cloaca. They are very ſmall and ſhort; and, from this circumſtance, they long eſcaped the notice of anatomiſts.

In the female, the cluſter of yolks, being analogous to the human ovaria, are attached to the back-bone by a membrane. This membrane is very thin, and continues down to the uterus. The yolk, after ſeparating from its ſtalk, paſſes into a canal called the *infundibulum*, where it receives a gelatinous liquor, which, with what it farther acquires in the uterus, compoſes the white of the egg. The uterus is a large bag, ſituated at the end of the infundibulum, and is full of wrinkles on the inſide. Here the egg receives it laſt covering, or ſhell, and is puſhed out of the vagina at an aperture placed immediately above the anus.

From this deſcription of the ſtructure of granivorous birds, the analogy between them and the herbivorous quadrupeds is conſpicuous. In both, the number of their ſtomachs, the length and capacity of their inteſtines, and the quality of their food, are very ſimilar. But this analogy is not confined to ſtructure and organs: It extends to manners and diſpoſitions. Like the herbivorous quadrupeds, this order of birds are diſtinguiſhed by the gentleneſs and complacency of their tempers. Contented with the ſeeds of plants, or ſmall inſects, the ſtronger never wage war with the weaker. Their chief attention is occupied in procuring food, in hatching and rearing their young; and their vigilance is kept perpetually active in eluding the ſnares of men and other rapacious animals. The whole are a timid race, and many of them are ſo tractable that they may eaſily be rendered domeſtic. Man, accordingly, ever attentive to his intereſt, has not failed to derive advantage from the innocence and ſtupidity of theſe animals. Of the gallinaceous and duck kind, which are the moſt prolific, and conſequently the moſt profitable, he has chiefly ſelected the hen, the gooſe, the duck, the turkey, and the peacock. In this ſelection he has diſcovered his ſagacity; for, inſtead of pairing, theſe birds are polygamous, one male being ſufficient to fertilize a number of females, which is a great ſaving in the article of food.

With regard to carnivorous birds, their general conformation is nearly the ſame with thoſe of the granivorous kind. They have the ſame number of ſtomachs; but all of them are ſmaller and weaker. Their inteſtines are alſo much ſhorter. To enable them to procure food, they are obliged to fly quickly, and continue long on the wing. Their wings, accordingly, are proportionally longer, and they have more ſtrength in their muſcles. For the purpoſe of ſeizing and devouring prey, Nature has beſtowed on them ſtrong hooked bills, and long ſharp claws or pounces. They have alſo large heads, ſhort necks, ſtrong brawny thighs, and ſharp-ſighted eyes.

Like rapacious quadrupeds, birds of prey are capable of enduring hunger for a great length of time. This faculty is, perhaps, acquired partly by habit; becauſe the obtaining of their food is often very precarious. The females are larger, ſtronger, and more beautiful both in ſhape and plumage, than the males. For this reaſon, the male hawks are called *tercels, or thirds*, becauſe they are ſuppoſed to be one third leſs than the females. Nature ſeems to have beſtowed this ſuperiority of ſize and ſtrength upon the female, becauſe ſhe is obliged to procure food both for herſelf and for her progeny.

The analogy between the ſtructure of rapacious birds and carnivorous quadrupeds is obvious. Both of them are provided with weapons which indicate deſtruction and rapine. Their manners, are alſo fierce and unſocial. They never, if the vulture be excepted, herd together in flocks, like the inoffenſive granivorous tribes. When not on the wing, they conceal themſelves on the tops of ſequeſtered rocks, or in the depths of the foreſts, where they ſpend their time in ſullen ſolitude. Thoſe of them which feed upon carion, as the raven, have the ſenſe of ſmelling ſo acute, that they ſcent dead carcaſſes at amazing diſtances.

Beſide theſe great diviſions of birds into granivorous and rapacious, whoſe manners and diſpoſitions perfectly coincide with the ſtructure of their bodies, there are other tribes to whom Nature has given peculiar organs. In all theſe deviations from the common ſtructure, a ſingularity in the mode of living, and the oeconomy of the animal, is the invariable reſult.

Like the amphibious animals, a number of fowls live chiefly in the water, and feed upon fiſhes and aquatic inſects. To enable them to ſwim and to dive in queſt of food, their toes are connected together by broad membranes or webs. By ſtretching their toes, and ſtriking the water backward with theſe webs, their bodies are moved forward, and they employ their tail as a rudder to direct their courſe. Without theſe additional inſtruments, fowls could not ſwim; and, accordingly, ſuch birds as are not provided with webs never take to the water. But thoſe furniſhed with webs have ſuch a ſtrong propenſity to water, that, when reſtrained from their favourite element, they diſcover the greateſt uneaſineſs, and, when their liberty is reſtored, they fly in a direct courſe either to the ſea, a river, or a lake.

There is another tribe of aquatic birds, ſome of which feed upon fiſhes and inſects, and others live principally by ſucking certain juices from mud. Both theſe kinds frequent marſhy places, or the margins of lakes and rivers. They do not ſwim, but wade, in queſt of food. This ſingularity in their manners required a correſpondent variation in their form and ſtructure. To enable them to wade in waters and in mires, Nature has provided them with longs legs, naked of feathers for a conſiderable ſpace above the knees. Their toes are not, like thoſe of the ſwimmers, connected by continued membranous webs. Moſt of them have likewiſe very ong necks and bills, to enable them to ſearch for and apprehend their food. To theſe tribes belong the crane, the herons, the bittern or mire-drum, the ſtork, the ſpoon-bill, the woodcock, the ſnipe, and many other ſpecies.

Having given a general idea of the ſtructure and oeconomy of birds, we ſhall next make a few remarks on the form and manners of fiſhes.

OF THE STRUCTURE AND ORGANS OF FISHES.

It is one great and benevolent intention of Nature, that no part of the univerſe ſhould be deprived of inhabitants. The earth, the air, the waters, are full of living beings, who are not only conſcious of their exiſtence, but enjoy degrees of happineſs proportioned to their natures, and the purpoſes they are deſtined to anſwer in the general ſcale of animation. The different elements in which they live neceſſarily required a variety in their form, their food, and their manners. The inhabitants of the earth and air have already been partially deſcribed: Thoſe of the waters are next to be conſidered.

The bodies of moſt fiſhes are covered with a ſtrong, thick, ſkin, in which numberleſs ſcales are inſerted in an imbricated form, or like tiles on the roofs of houſes. Many of them, and particularly thoſe which are ſhaped like the cod, the trout, and the haddock, have a longitudinal line on each ſide. In theſe lines there are a number of ſmall ducts or apertures, which throw out a mucous ſubſtance that lubricates their ſkins, and ſeems to anſwer the ſame purpoſes as the mucous glands or ducts placed in moſt of our internal organs.

Fiſhes are deſtitute of hands and feet. Their progreſſive motion, therefore, is performed in a manner different from that of quadrupeds and birds. Their inſtruments of motion are fins, or machines conſiſting of a number of elaſtic beams, connected to one another by firm membranes. Their tails are of the ſame texture. Their ſpine is remarkably flexible toward the poſterior part of the body, and here the ſtrongeſt muſcles are likewiſe inſerted. They have a power of contracting and dilating their tails at pleaſure; by which means, and by the aſſiſtance of the fins, they move forward in the ſame manner as a boat with oars on its ſides and a rudder at its ſtern. Fiſhes have no neck: As they ſeek their food in a horizontal poſition, and can move their bodies either upward or downward, a long neck would neceſſarily have impeded their motion through the water.

The form of fiſhes is extremely various; and, if their hiſtory were ſufficiently known, the connection between their ſtructure and their manners would be equally apparent as in the other tribes with which we are better acquainted. Some fiſhes are long and cylindrical, as the ſea-ſerpent, and all the eel-ſhaped ſpecies. The eel-kind, from their figure, are enabled to trail their bodies along the bottom, and to conceal themſelves below the ſand or mud. Others are leſs cylindrical, and proportionally ſhorter, as the mackrel, the cod, the herring, the ſalmon, &c. Theſe, from the number and poſition of their fins, as well as from the ſhape of their bodies, are deſtined for quicker motion, and for travelling to great diſtances in queſt of food, or for ſpawning in ſhoals or in rivers. Others, as the flounder, the ſkate, the turbet, torpedo, &c. are broad and compreſſed. Theſe, like the eel-kind, frequent muddy bottoms. Others are triangular, quadrangular, round, &c. Beſide thoſe which approach to regular figures, the variations and compoſitions are ſo numerous, that the forms of fiſhes are much more diverſified than thoſe of quadrupeds or birds. To defend themſelves againſt their enemies, many fiſhes are armed with ſtrong, ſharp ſpines or prickles. For the ſame purpoſe, and likewiſe for wounding or killing their prey, ſome have a large horn on their front, and others a ſword, or rather a ſaw, which are tremendous weapons. The more timid and defenceleſs tribes are endowed with the faculty of rapid motion; and ſome of them have fins ſo large and flexible, that, when hard purſued, they are enabled to leave their natural element, to dart through the air to conſiderable diſtances, and diſappoint the deſigns of their enemies.

Fiſhes are as much diverſified in ſize as in figure. The ocean produces the largeſt animals which now inhabit this globe. The enormous maſſes of the whale and walrus tribes far exceed thoſe of the elephant, rhinoceros, or river-horſe, the largeſt terreſtrial animals of which we have any proper knowledge. From the immenſe bones, however, found in Siberia and many parts of Europe, we are induced to believe, that land animals have formerly exiſted whoſe ſize muſt have been much larger than that of the preſent elephant. This animal, whoſe ſpecies is now ſuppoſed to be extinguiſhed, is known among naturaliſts by the denomination of the *mammouth*. Near the river Ohio, ſome prodigious bones and teeth have lately been diſcovered, which indicate an animal of incredible magnitude.

With regard to internal ſtructure, fiſhes, like land-animals, are furniſhed with a back-bone and ribs, which run from the head to the tail. To theſe, the bones of the head, and the fins, all the muſcles and inſtruments of motion, are attached.

The mouths of moſt fiſhes are furniſhed with teeth; but in ſome, as the mullet, ſturgeon, &c. the teeth are wanting. In ſome, the teeth are ſituated on the jaw-bones, in others, on the tongue and palate. The teeth of fiſhes are principally deſigned for laying hold of and detaining their prey, which they generally ſwallow entire. For this purpoſe, the teeth are commonly ſerrated, or bent inward, like tenter-hooks. By this ſtructure, ſmall fiſhes are eaſily forced downwards, and their return is at the ſame time prevented.

In fiſhes, the organ of ſmelling is large; and they have a power of contracting and dilating, at pleaſure, the entry into their noſe.

It was formerly doubted whether fiſhes were endowed with the ſenſe of hearing. But that doubt is now fully removed; becauſe it has been found, that, like other animals, they have a complete organ of hearing, and that water is a proper medium for the conveyance of ſound. Beſides, in the ſkate, and ſome other genera, the learned and ingenious Dr Monro, Profeſſor of Anatomy in the College of Edinburgh, has lately diſcovered an aperture which leads directly to the internal parts of the ear.

The gullet of fiſhes is ſo ſhort that it is hardly to be diſtinguiſhed from the ſtomach, which is of an oblong figure. The guts are very ſhort, making only three convolutions, the laſt of which terminates in the common vent for the faeces, urine, and ſemen. From this ſtructure of the ſtomach and inteſtines, analogy would lead us to conclude, that fiſhes live chiefly upon animal food. Experience, accordingly, teaches us, that almoſt all fiſhes prey upon the ſmaller kinds, and even devour their own young. The liver is proportionally large, of a whitiſh colour, and ſituated on the left ſide. The gall-bladder lies at a conſiderable diſtance from the liver, and diſcharges the gall into the gut. In fiſhes, the organs of generation are two bags ſituated in the abdomen, and uniting near the anus. In the male, theſe bags are filled with a thick whitiſh ſubſtance called the *milt*, and in the female with an infinite number of minute eggs called the *roe*. At the ſeaſon of ſpawning, the bags of both male and female are greatly diſtended; but, at other times, the male organs can ſcarcely be diſtinguiſhed from thoſe of the female.

The ſwimming bladder is an oblong, white, membranous bag, which contains nothing but a quantity of elaſtic air. It lies cloſe to the back-bone, and has a pretty ſtrong muſcular coat. By contracting this coat, and, of courſe, condenſing the air it contains, ſome fiſhes are enabled to render their bodies ſpecifically heavier than water, and to ſink to the bottom; and, when the muſcular fibres ceaſe to act, the air dilates, and makes their bodies ſpecifically lighter. By this curious piece of mechaniſm, the animals have the power of ſinking to the bottom, or of riſing to the ſurface. According to the different degrees of contraction and dilatation of this bladder, fiſhes can, at pleaſure, keep themſelves higher or lower in the water. Hence flounders, ſoles, ſkate, and other fiſhes which have no ſwimming bladder, always grovel at or near the bottom. It is likewiſe a conſequence of the relaxation of this bladder, that dead fiſhes which are furniſhed with it uniformly riſe to the ſurface. The air-bag, in ſome fiſhes, communicates, by a duct, with the gullet, and, in others, with the ſtomach. At the upper end of the air-bag, there are red-coloured glandular bodies connected with the kidneys. From the kidneys the ureters proceed downward to their inſertion in the urinary bladder, which lies in the lower part of the abdomen, and the urethra terminates in the anus.

Fiſhes have a membranous diaphragm, or midriff, that forms a ſack in which the heart is contained. The heart is of a triangular figure. It has only one auricle, one ventricle, and one great artery. This artery, inſtead of ſupplying all the parts of the body, as in the frog, is diſtributed entirely on the gills. All the branches terminate there, and become at laſt ſo ſmall that they eſcape the naked eye. The branchiae, or gills, lie in two large ſlits on each ſide of the head, and are analogous to the lungs of land-animals. The figure of the gills is ſemicircular, and on each ſide of them are immenſe numbers of fibrils reſembling fringes. The gills are perpetually ſubjected to an alternate motion from the preſſure of the water and the action of the muſcles. They are covered with a large flap, which allows an exit to the water neceſſarily taken in by the animals every time their mouths are opened. The blood is again collected by a vaſt number of ſmall veins, which, inſtead of going back a ſecond time to the heart, immediately unite, and form an aorta deſcendens, which ſends off branches to ſupply all the parts of the body, except the gills. From the extremities of theſe branches the blood is collected by veins, and returned to the heart nearly in the ſame manner as in other animals.

The organs by which the nutritious part of the food of fiſhes are extracted and conveyed to the general maſs of blood, and known by the names of lacteal, abſorbent, and lymphatic veſſels, are ſo analogous to thoſe of men and quadrupeds, that it is unneceſſary to deſcribe them. For the ſame reaſon, no deſcription ſhall be given of the nerves, which, as in other animals, proceed from the brain and ſpinal marrow, and are diſtributed over every part of the body.

Having finiſhed this ſketch of the ſtructure and organs of fiſhes, it is almoſt needleſs to remark, that, though they live in a different element, and vary greatly from land-animals in figure, Nature, in the formation of their bodies, in the mode of their nutrition, reſpiration, and ſenſation, has acted upon the ſame great and general plan.

We are now to take a view of the ſtructure of inſects, a numerous claſs of animals, moſt of whom recede farther from the common mode of animal organization than any of the other claſſes.

OF THE STRUCTURE OF INSECTS.

In the firſt chapter, a few obſervations were made concerning the ſtructure and organs of inſects, in order to ſhow more clearly the analogies between animals and vegetables. Theſe it is unneceſſary to repeat. We ſhall therefore proceed to a more particular examination of the ſtructure of inſects, and to trace the connection between that and their manners.

Inſects exhibit ſuch an immenſe variety in figure, colour, and diſpoſition of parts, that Naturaliſts have found it neceſſary to arrange them into different tribes or families. Theſe tribes are diſtinguiſhed from one another by certain peculiarities in the ſtructure of their bodies.

The moſt general diviſion of inſects is derived from the circumſtance of their having or wanting wings, and from the number and ſubſtances of which theſe inſtruments of motion are compoſed. They are diſtinguiſhed from all other animals by many peculiarities of form. None of the other claſſes have more legs than four. But moſt inſects have ſix; and many of them have eight, ten, fourteen, ſixteen, eighteen, and even a hundred, legs. Beſide the number of legs, inſects are furniſhed with antennae or feelers. Theſe feelers, by which inſects grope and examine the ſubſtances they meet with, are compoſed of a great number of articulations or joints. Linnaeus, and other Naturaliſts, maintain, that the uſes of theſe feelers are totally unknown. But the ſlighteſt attention to the manner in which ſome inſects employ their feelers will ſatisfy us of at leaſt one uſe they derive from theſe organs. When a wingleſs inſect is placed at the end of a twig, or in any ſituation where it meets with a vacuity, it moves the feelers backward and forward, elevates, depreſſes, and bends them from ſide to ſide, and will not advance farther, leſt it ſhould fall. Place a ſtick, or any other ſubſtance, within reach of the feelers; the animal immediately applies them to this new object, examines whether it is ſufficient to ſupport the weight of its body, and inſtantly proceeds in its journey. Though moſt inſects are provided with eyes, yet the lenſes of which they conſiſt are ſo ſmall and convex, that they can ſee diſtinctly but at ſmall diſtances, and, of courſe, muſt be very incompetent judges of the vicinity or remoteneſs of objects. To remedy this defect, inſects are provided with feelers, which are perpetually in motion while the animals walk. By the ſame inſtruments, they are enabled to walk with ſafety in the dark.

No other animals but the inſect tribes have more than two eyes. Some of them have four, as the phalangium; others, as the ſpider and ſcorpion, have eight eyes. In a few inſects, the eyes are ſmooth; in all the others, they are hemiſpherical, and conſiſt of many thouſand diſtinct lenſes. The eyes are abſolutely immoveable: But this defect is ſupplied by the vaſt number of lenſes, which, from the diverſity of their poſitions, are capable of viewing objects in every direction.

rection. By the ſmallneſs and convexity of theſe lenſes, which produce the ſame effect as the object glaſs of a microſcope, inſects are enabled to ſee bodies that are too minute to be perceived by the human eye.

Another peculiarity deſerves our notice. No animal, except a numerous tribe of four-winged inſects, have more than two wings.

With regard to ſex, quadrupeds, birds, and fiſhes, are diſtinguiſhed into males and females. But the bee and the ant furniſh examples of neuters, which are abſolutely barren: And the earthworm, and ſeveral ſhell inſects, are hermaphrodite, each individual poſſeſſing the prolific powers of both male and female.

It is likewiſe remarkable, that all winged inſects undergo three metamorphoſes or changes of form: The egg is diſcharged from the body of the female in the ſame manner as in other oviparous animals. By a wonderful inſtinct, theſe ſeemingly ſtupid creatures uniformly depoſit their eggs on ſuch animal or vegetable ſubſtances as furniſh proper food for the worm or caterpillar, that is to be hatched by the heat of the ſun. The worm or caterpillar is the firſt ſtate. The bodies of caterpillars are ſoft and moiſt. They have no wings, and are totally deprived of the faculty of generation. After continuing for ſome time in this reptile ſtate, they are transformed into a chryſalis, which is drier and harder than the caterpillar. The chryſales of ſome inſects are naked, and thoſe of others are covered with a ſilken web, ſpun by the animals before their change is completed. In this ſtate, many of them lie motionleſs, and ſeemingly inanimate, during the whole winter. When the ſpring or ſummer heats return, they burſt from their laſt priſon, and, from vile reptiles, are transformed into beautiful flies. In this perfect ſtate they are exceedingly active, fly about in queſt of their mates, and, after propagating their ſpecies, the females depoſit their eggs, and the ſame circle of animation and change perpetually goes round. Hence the ſtructure and figure of the ſame individual animals are threefold, which renders the knowledge of inſects extremely complicated, as we muſt be acquainted with them in the ſeveral forms they ſucceſſively aſſume.

There is another peculiarity in the ſtructure of inſects. They are deprived of bones. But that defect is ſupplied, in ſome, by a membranous or muſcular ſkin, and, in others, by a cruſtaceous or horny covering. In this circumſtance, inſects reſemble the ſhell-animals, whoſe bones conſtitute the external parts of their bodies.

In general, the bodies of inſects are compoſed of a head, trunk, and abdomen. The head is commonly attached to the trunk by a joint or articulation. Beſide eyes, feelers, and mouth, the heads of ſome inſects are furniſhed with *palpi* fixed to the mouth; and they are either four or ſix in number. Each of them conſiſts of two, three, or four joints, and are often miſtaken for the antennae or feelers. Theſe inſtruments ſeem to ſerve the animals inſtead of hands; for they employ the palpi to bring the food to their mouths, and to keep it ſteady while eating. It is aſſerted by Linnaeus, and other Naturaliſts, that the heads of inſects are deſtitute of brains, noſtrils, and ears. The minuteneſs of the animals under conſideration may have hitherto prevented us from diſtinguiſhing theſe organs. If they want a brain, it is certain that their ſenſe of ſeeing is acute; and we know that they are amply ſupplied with nerves, which produce the ſame effects as the brain in larger animals. If they are deprived of noſtrils, the ſlighteſt attention muſt convince us, that ſome of them poſſeſs the ſenſe of ſmelling in a very high degree. Upon any other ſuppoſition, how ſhould the different ſpecies of flies, the moment they eſcape from the chryſalis ſtate, diſtinguiſh, and directly approach, the different animal and vegetable ſubſtances Nature has deſtined for their reſpective nouriſhment? A piece of meat is no ſooner expoſed to the air than it is covered with fleſh flies, upon which they both feed and depoſit their eggs. Without this ſenſe, how ſhould waſps, and other flies, be allured from conſiderable diſtances into bottles encruſted with honey or molaſſes? Theſe, and ſimilar actions, cannot be effects of ſight; for the diſtance, the minuteneſs, and frequently the poſition of the food, render it impoſſible for the eye to diſcover thoſe ſubſtances to which they inſtantly reſort.

With regard to hearing, it is more difficult to determine whether inſects be endowed with this ſenſe. We can judge of it, not by the knife of the Anatomiſt, but by the affections and motions of the animals themſelves. Several trials I have made on houſe-flies incline me to think that theſe animals poſſeſs a ſenſe of a nature ſimilar, at leaſt, to that of hearing. At the diſtance of three or four feet, a ſmart ſtroke, even upon a ſtone wall, alarms and puts them to flight. But this may partly be attributed to the vibration in the wall, or the concuſſion of the air, produced by the ſtroke. To obviate this difficulty, at the ſame diſtance of between three and four feet, I ſtruck the air repeatedly with a bookbinder's folder, without giving the ſmalleſt alarm to the flies. But, when I ſtruck the folder againſt the boards of a book, which I held in my hand, and made a ſmart noiſe, the animals were inſtantly alarmed, and flew off at the ſecond ſtroke. The ſame effect is produced in a room juſt light enough to render the animals viſible. Theſe trials, which I have often repeated, ſeem to indicate that flies, if they are really deprived of ears, are endowed with an analogous ſenſe, though we are ignorant of its ſituation.

Naturaliſts have limited the ſenſes of inſects to thoſe of ſeeing and feeling. But the above remarks render it more than probable that flies poſſeſs likewiſe the ſenſes of ſmelling and of hearing: Neither ſhould the ſenſe of taſte be denied them; for, though they may be aſſiſted by ſmelling to diſcover and ſelect their food, we cannot ſuppoſe that Nature has denied them the pleaſure which other animals ſo univerſally derive from eating. Beſides, an agreeable ſenſation, ſimilar to that of taſte, muſt accompany an action which removes the pain ariſing from hunger.

The mouth of inſects is generally placed in the under part of the head; but, in ſome, it is ſituated in the breaſt. The jaws, inſtead of being horizontal, are often tranſverſe, and furniſhed with teeth. The greater number of winged inſects are provided with a proboſcis or trunk, an inſtrument by which they extract the juices from animal or vegetable ſubſtances. The proboſcis of inſects is a machine of a very complicated nature. In butterflies, the proboſcis is ſituated preciſely between the two eyes. Though ſome of them exceed three inches in length, they occupy but a ſmall ſpace. When a butterfly is not in queſt of food, the proboſcis is rolled up in a ſpiral form, ſimilar to that of a watch-ſpring, each ſucceſſive ring covering the one which precedes. The ſubſtance of the proboſcis has ſome reſemblance to that of horn. It tapers from the baſe to the extremity. It is compoſed of two ſimilar and equal parts, each of which is concave, and, when joined, form three diſtinct tubes. Reaumur has rendered it probable, that theſe tubes enable the animals to extract the juices of plants, to conduct air into their bodies, and to convey the ſenſation of ſmelling. Hence the proboſcis of inſects is an inſtrument which ſerves them for a mouth, a noſe, and a wind-pipe.

The upper part of the trunk or body of inſects is called the thorax, and the under part the abdomen or belly. The abdomen contains the ſtomach and other viſcera. It conſiſts of ſeveral rings or ſegments, and is perforated with ſpiracula, or tubes, which ſupply the want of lungs. The abdomen is terminated by the tail, which, in ſome inſects, is armed with a ſting, a forceps, a briſtle, or a kind of claw with a moveable thumb.

The legs are compoſed of three parts, connected to each other by joints, and repreſent the thighs, ſhanks, ankles, and feet of larger animals.

The wings of inſects are ſo diverſified in number, conſiſtence, and colour, that Linnaeus has made them the foundation of the ſeveral orders or diviſions into which he divides this numerous claſs of animals. Some inſects are furniſhed with four, and others with two wings, and ſome of them are entirely deſtitute of theſe inſtruments of motion.

The four-winged inſects are arranged into five orders. The *firſt* order Linnaeus diſtinguiſhes by the name of *coleoptera*, or thoſe inſects whoſe upper pair of wings conſiſt of a hard, cruſtaceous, or horny ſubſtance. Theſe cover and defend the under pair, which are of a more ſoft and flexible texture. This order comprehends the whole of what is properly called *ſcarabaei*, or the beetle tribe. Like other winged inſects, all the beetles live for ſome time in the form of caterpillars, or grubs.

As a farther confirmation of the connection of manners with form and ſtructure, it is here worthy of remark, that the ſame animals, when in the ſtate of caterpillars, live in a different manner, and feed on ſubſtances of a very different kind from thoſe they conſume after their transformation into flies. The caterpillars of the garden-beetle, cock-chafer, &c. lead a ſolitary life under ground, and conſume the roots of plants. Thoſe of others feed upon putrid carcaſſes, every kind of fleſh, dried ſkins, rotten wood, the dung of men and quadrupeds, and the ſmall inſects called *pucerons*, or *vine-fretters*. The devourers of the puceron contribute to cure ſuch plants as happen to be infected with the *phthiriaſis*, or louſy diſeaſe. But, after their transformation into flies, many of the ſame animals, which formerly fed upon dung and putrid carcaſſes, are nouriſhed by the pureſt nectareous juices extracted from fruits and flowers. The creatures themſelves, with regard to what may be termed *individual animation*, have ſuffered no alteration. But the fabrick of their bodies, their inſtruments of motion, and the organs by which they take their food, are materially changed. This change of ſtructure, though the animals retain their identity, produces the greateſt diverſity in their manners, their oeconomy, and the powers of their bodies. In the caterpillar ſtate, theſe animals are extremely voracious, and, in many inſtances, acquire a greater magnitude than they poſſeſs after transformation ; but they are incapable of multiplying their ſpecies, and of receiving nouriſhment from the ſame kinds of food. Beſides, many caterpillars, previous to their transformation, live even in a different element. The ephemeron fly, when in the caterpillar ſtate, lives no leſs than three years in the water, and extracts its nouriſhment from earth and clay. After transformation, this animal ſeldom exiſts longer than one day, during which the ſpecies is propagated, and myriads of eggs are depoſited on the ſurface of the water. Theſe eggs produce worms or caterpillars, and the ſame proceſs goes perpetually round.

Linnaeus's *ſecond* order of inſects, or *hemiptera*, have likewiſe four wings. But the upper pair, inſtead of being hard and horny, rather reſemble fine vellum. They cover the body horizontally, and do not meet in a direct line, forming a ridge or ſuture, as in the beetle tribe. The whole of this order are furniſhed with a proboſcis or trunk for extracting their food.

This order comprehends ſeveral genera or kinds, ſome of which we ſhall mention in a curſory manner.—The *blatta, or cockroach*, is an animal which avoids the light, and is particularly fond of meal, bread, putrid bodies, and the roots of plants. It frequents bakers ſhops and cellars, and flies the approach of danger with great ſwiftneſs.—The head of the *mantis*, or *camel-cricket*, appears, from its continual nodding motion, to be ſlightly attached to the thorax. This inſect is regarded by the Africans as a ſacred animal; becauſe it frequently aſſumes a praying or ſupplicating poſture, by reſting on its hind feet, and elevating and folding the firſt pair.—The *gryllus* comprehends a number of ſpecies, ſome of which are called *graſshoppers*, others *locuſts*, and others *crickets*. The *larvae*, or caterpillars of the grylli, have a great reſemblance to the perfect inſects, and, in general, live under ground. Many of theſe inſects feed upon the leaves of plants. Others, which live in houſes, prefer bread, and every kind of farinaceous ſubſtance.—The *fulgora*, or firefly: The foreheads of ſeveral of this genus, eſpecially of thoſe that inhabit China, and other hot climates, emit a very lively ſhining light during the night, which often alarms thoſe who are unacquainted with the cauſe of the appearance.—The *cicada*, *frog-hopper*, or *flea-locuſt*: The *larvae*, or caterpillars, of ſome of this genus, diſcharge a kind of froth or ſaliva from the anus and pores of the body, under which they conceal themſelves from the rapacity of birds and other enemies.—The *papa* or *water ſcorpion*, frequents ſtagnant waters. It lives chiefly on aquatic inſects, and is exceedingly voracious.—The *cimex* or bug: Many ſpecies of this genus feed upon the juices of plants, and others upon the blood of animals. Some of them are found in waters, and others frequent houſes, among which, though it wants wings, is the bed-bug, a peſtiferous inſect, which is too well known, and too generally diffuſed. The bugs differ from other inſects by their ſoftneſs; and moſt of them emit a very foetid ſmell.—The *aphis*, *puceron*, or *vine-fretter:* Theſe inſects are very common, and are generally termed the *lice* of the plants which they infeſt: The puceron, as remarked in the firſt chapter, is viviparous in ſummer, and oviparous in autumn. Numbers of them are devoured by the ants, on account, as is ſuppoſed, of a ſweet liquor with which their bodies are perpetually moiſtened.—*Chermes:* The *larvae* or caterpillars of this inſect have ſix feet, and are generally covered with a hairy or woolly ſubſtance. The winged inſects leap or ſpring with great agility, and infeſt a number of different trees and plants: The females, by means of a tube at the termination of their bodies, inſert their eggs under the ſurface of the leaves, and the worms, when hatched, give riſe to thoſe tubercles, or galls, with which the leaves of the aſh, the fir, and other trees, are ſometimes almoſt entirely covered.

The *third* order or tribe of four-winged inſects conſiſts of three genera only. But the ſpecies comprehended under them are exceedingly numerous. All butterflies and moths belong to this order. Their wings are covered with a farinaceous powder, or rather with a kind of ſcales or feathers, diſpoſed in regular rows, nearly in the ſame manner as tiles are laid upon the roofs of houſes. The elegance, the beauty, the variety of colours exhibited in their wings, are produced by the diſpoſition and different tinctures of theſe minute feathers. The inſects of this order, on account of their beauty and eaſy preſervation, have always been the favourites of collectors, and particularly of thoſe of the female ſex. When the feathers are rubbed off, the wings appear to be nothing more than a naked, and often a tranſparent membrane. The feelers of the *papilio*, or *butterfly*, are thickeſt at their extremity, and often terminate in a kind of capitulum, or head. Their wings, when ſitting, or at reſt, are erect, their extremities join each other above the body, and the animals fly about, in queſt of food and of their mates, during the day.—The *moths* are divided into two genera, the one called *ſphinx*, or *hawk moth*, and the other *phalaena*, or *moth*. The feelers of the *ſphinx* are thicker in the middle than at the extremities, and their form, in ſome meaſure, reſembles that of a priſm. The wings are, in general, deflected, their outer margins declining toward the ſides. They fly about early in the morning, and after ſun-ſet; and, by means of their proboſcis, like the butterflies, they ſuck the juices of plants.—The *phalaena*, or *moth:* The feelers of this genus are ſetaceous, and taper from the baſe to the point. When at reſt, their wings are commonly deflected; and they fly during the night. Previous to their transformation, the caterpillars of the whole of this genus ſpin webs for covering and protecting the animals while in the chryſalis ſtate. From a ſpecies of this tribe mankind have derived one of the greateſt articles of luxury and of commerce which now exiſts in the world. That ſeemingly contemptible, that diſguſting reptile known by the appellation of the *ſilk-worm*, in its paſſage from the caterpillar to the chryſalis ſtate, produces thoſe ſplendid materials which adorn the thrones of Princes, and add dignity and luſtre to female beauty *.

The wings of the *fourth* order, diſtinguiſhed by the name of *neuroptera*, are membranaceous, naked, and ſo interſperſed with delicate veins, that they have the appearance of beautiful net-work. Their tail has no ſting; but that of the male is frequently furniſhed with a kind of forceps or pincers. To this order belongs the *libella*, or *dragon-*

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* See Chap. XI. concerning the Transformation of Animals.

dragon-fly, an inſect of very ſplendid and variegated colours. It is a large and well known fly, and frequents rivers, lakes, pools, and ſtagnating waters, in which the females depoſit their eggs. Their mode of generating is ſingular. Different ſpecies of them appear from the beginning of ſummer to the middle of autumn. They generally fly in pairs, and in a ſtraight line, the male purſuing the female. The organs of the male are ſituated in his breaſt: When he overtakes her, with the forceps in his tail he lays hold of her by the neck, while ſhe, by an inſtinctive impulſe, makes the lower end of her body approach the male organs. In this united ſituation they form a kind of ring, have the appearance of a double animal, and fly along till the purpoſe is accompliſhed. Under the ſame order is comprehended the *phryganea*, or *ſpring-fly*: The larvae or caterpillars of this genus live in the water, and are covered with a ſilken tube. They have a very ſingular aſpect; for, by means of a gluten, they attach to the tubes in which they are incloſed ſmall pieces of wood, ſand, gravel, leaves of plants, and not unfrequently live teſtaceous animals, all of which they drag along with them. They are very commonly found in ſalads of the water-creſs; and, as they are often entirely covered with green leaves, they have the appearance of animated plants. They are in great requeſt among fiſhermen, by whom they are diſtinguiſhed by the name of *ſtone*, or *cod-bait*. The fly, or perfect inſect, frequents running waters, in which the females depoſit their eggs.

The *fifth* order is termed *hymenoptera*. In general, the inſects belonging to this order have four membranaceous and naked wings. In ſome of the genera, however, the neuters, and, in others, the males, or even the females, have no wings. Their tails, except in the male ſex, are armed with a ſting.—The female of the *cynips*, an inſect belonging to this order, inſerts her eggs into the leaves of the oak, and the caterpillars produced from them give riſe to the galls employed in the compoſition of ink.—This order likewiſe includes the waſp, the bee, and the ant. Many of the waſp kind, like the bees, live in ſociety, make combs in which the females depoſit their eggs, and feed their caterpillars with an inferior ſpecies of honey. Others of them conſtruct a ſeparate neſt for each individual egg.—The bee is an inſect too well known to require a particular deſcription. The males have no ſting; but the females, and the drones, or neuters, have a very ſharp pointed ſting concealed in their abdomen. The female of the honey bee is much larger than the male, or the neuter. Her feelers contain fifteen articulations. Her abdomen is compoſed of ſeven ſegments, and is much longer than her wings. The feelers of the male contain only eleven articulations. The neuters are much ſmaller than the males or females, and their feelers conſiſt of fifteen articulations.—The ſting, with which the male and female *ants* are armed, is concealed within the abdomen. The males and females of the ant are furniſhed with wings, but the neuters are deprived of theſe inſtruments of motion. The ants live in ſocieties which are compoſed of males, females, and neuters. The males are much ſmaller than the females and neuters. Soon after the males and females propagate the ſpecies, they all die. Some of the neuters, however, ſurvive the winter; but they remain in their habitation without movement, or diſcovering any ſigns of life. From theſe circumſtances in the hiſtory of ants, it is apparent, that the induſtry and ſagacity ſo long and ſo univerſally aſcribed to theſe little animals could be of no uſe either to themſelves or their progeny. The female, after depoſiting her eggs, takes no farther care of her offspring. But, what is ſingular, the important office of feeding the *larvae*, or caterpillars, after the eggs are hatched, is left entirely to the neuters. This affectionate and aſſiduous attention of the neuters to a progeny neither begot nor brought forth by them, is ſo aſtoniſhing, ſo contrary to the general oeconomy of Nature, that no reaſoning or theory can account for a fact ſo uncommon, till farther diſcoveries ſhall be made in the hiſtory of theſe ſurpriſing animals. What is ſtill more ſingular, after the caterpillars are transformed into the chryſalis ſtate, the neuters are inceſſantly and anxiouſly employed in preſerving the chryſales from humidity when the weather is wet, and in expoſing them to the warmth of the ſun when it is fair. Theſe chryſales are larger than the animals themſelves, and yet they carry them off with eaſe and rapidity.

The *ſixth* order of inſects is termed *diptera*, or two-winged inſects. The different ſpecies of this order, beſide wings, are furniſhed with what is called a *balter*, or a *poiſer*, which is ſituated under each wing, and is terminated by a *capitulum*, or knob. This order comprehends ten genera and a multitude of ſpecies. The caterpillars of the *oeſtrus*, or *gad-fly*, lie concealed in the ſkins of cattle, where they are nouriſhed during the whole winter. The perfect inſects are frequent wherever horſes, cows, or ſheep, are grazing. Some of them depoſit their eggs in the ſkins of cows or oxen; others depoſit them in the inteſtines of horſes, to which they get acceſs by the anus; and others in the noſtrils of ſheep. In theſe habitations, the caterpillars reſide till they are full grown, when they throw themſelves down to the earth, and generally paſs the chryſalis ſtate under the firſt ſtone they meet with.—The *muſca*, or common *fly:* The mouth of this inſect conſiſts of a ſoft, fleſhy proboſcis, with two lateral lips. The caterpillars of ſome of this genus devour the pucerons; others conſume all kinds of putrid fleſh; others are found in cheeſe; others in the excrements of different animals; and many of them live in the water, and prefer that which is moſt corrupted and muddy.—The mouth of the *culex*, or *gnat* conſiſts of a flexible ſheath, incloſing four briſtles, or pointed ſtings. The feelers of the female gnat are plain like a thread; but thoſe of the male are beautifully feathered. The worms or caterpillars of this genus are commonly found in ſtagnant waters. The gnats generally frequent woods and marſhy places. The females, in particular, are very troubleſome, and ſting ſeverely.—The feet of the *hippoboſca*, or *horſe-fly*, are armed with a number of nails or crotchets. In ſome ſpecies, the wings croſs each other; in others, they are open. The horſe-flies frequent woods and marſhy grounds, and are extremely incommodious to birds and quadrupeds, whoſe blood is the only food of theſe inſects.

The *ſeventh* order of inſects Linnaeus denominates *aptera*, becauſe neither males nor females are furniſhed with wings. This order comprehends thirteen genera, and a great number of ſpecies, many of which are very offenſive and noxious to the human ſpecies. The *pediculus*, or *louſe*, has ſix legs, two prominent eyes, and its mouth contains a ſting or ſucker, by which it extracts blood and other juices from the bodies of animals. Though almoſt every different animal is infeſted with a peculiar ſpecies of lice, the ſpecific characters of very few of them have hitherto been aſcertained. Lice are of various forms. Some of them are oval, others oblong, and others long and ſlender. They are oviparous animals, and their eggs are large in proportion to the ſize of their bodies. Before they arrive at maturity, they change their ſkin ſeveral times. They are ſuppoſed to be hermaphrodites. This circumſtance, if true, may partly account for their prodigious multiplication. Swammerdam, who diſſected a great number, aſſures us, that he never found one without an ovary, nor ever diſcovered the organs peculiar to the male ſex. If this ſtructure be univerſal, the louſe is an hermaphrodite of a very peculiar kind; becauſe it muſt be capable of foecundating itſelf. Several ſpecies of worms are hermaphrodites; but, inſtead of foecundating themſelves, they are obliged to impregnate each other.—The *pulex*, or *flea*, has likewiſe ſix legs, the articulations of which are ſo exceedingly elaſtic, that the animal is enabled by their means, to ſpring to ſurpriſing diſtances. It has two fine eyes, and its body is covered with cruſtaceous ſcales. The flea is the only inſect belonging to this order which undergoes a transformation ſimilar to that of the former orders: All the other wingleſs inſects are produced in a perfect ſtate either by the mother, or from eggs. The caterpillars of the flea have forked tails, and are very ſmall and lively. They may be nouriſhed in boxes, and fed with flies, which they greedily devour. Before changing into the chryſalis ſtate, they live fourteen or fifteen days in the form of caterpillars.—*Aranea*, or ſpider: This genus comprehends a great many ſpecies. The ſpider has eight feet, and an equal number of immoveable eyes. The chief prey of the ſpider is flies, animals whoſe motions are extremely quick and deſultory. To enable the ſpider to obſerve their movements in every direction, ſhe is furniſhed with eight eyes, the poſition of which merits attention: Two of them are placed on the top of the head, other two on the front, and two on each ſide. The mouth is armed with two crotchets, by which it ſeizes and kills its prey. Round the anus there are ſeveral muſcular inſtruments, ſhaped like nipples or teats. Each of theſe contain about a thouſand tubes or outlets for threads ſo extremely minute, that many hundreds of them muſt be united before they form one of thoſe viſible ropes of which the ſpider's web is compoſed. The figure of the web varies according to the ſpecies, or the ſituation the animal chooſes for its abode. After the web is completed, ſome ſpecies reſide in the center, and others occupy the extremity of their habitations, where they lie in ambuſh, with aſtoniſhing patience, till an ill-fated fly is accidentally entangled. The ſpider, from the vibration of the threads, perceives his prey, ruſhes forth from his cell, inſtantly ſeizes it with his fangs, devours its vitals, and afterwards rejects the exhauſted carcaſe. Spiders prey upon all weaker inſects, and even upon their own ſpecies.—The *ſcorpion:* This venomous inſect is a native of warmer climates than thoſe of the north of Europe.

rope. It has eight feet, and two claws, the laſt of which are ſituated on the fore part of the head. Like the ſpider, the ſcorpion has eight eyes, three of which are placed on each ſide of the breaſt, and the other two on the back. The tail is long, jointed, and terminates in a ſharp crooked ſting. The venom of the ſcorpion is more deſtructive than that of any other inſect; and is ſometimes fatal in Africa and other hot regions.

The *laſt* diviſion of inſects is termed *vermes*, or *worms*, by Linnaeus. This claſs comprehends not only all the inſects commonly called *worms*, but all the teſtaceous animals, and the zoophites, or plant-animals. The ſtructure of ſeveral genera belonging to this claſs is extremely ſingular. After giving a few examples, we ſhall haſten to the concluſion of the preſent ſubject.

The body of the *gordius*, or *hair-worm*, is long, ſhaped like a thread or hair, ſmooth, and round. A ſpecies of the hair-worm is very common in our freſh waters, and is perfectly harmleſs. In Scotland, it is a vulgar and fooliſh notion, that the hair of a horſe's tail, when thrown into the water, is converted into this worm. Though inoffenſive in this country, the hair-worm of Africa, and of both the Indies, is extremely noxious. It is of a pale yellowiſh colour, and is frequently met with among the graſs, eſpecially when covered with dew. It often inſinuates itſelf into the naked feet or limbs of children and unwary perſons, where it produces an inflammation, which is ſometimes fatal. It may be extracted by tying a thread round its head, and then pulling it gently out of its abode. But this operation requires great caution; for, if the animal is broken, the part which remains does not die, but, in a ſhort time, regains what it had loſt, and becomes equally entire and troubleſome as if it had received no injury.—The *lumbricus*, or *earth-worm:* The body of this worm is cylindrical, conſiſts of many rings, and the middle is encompaſſed with an elevated belt. It is likewiſe furniſhed with ſharp prickles, which the animal can erect or depreſs at pleaſure. Through certain perforations in the ſkin, it occaſionally emits a ſlimy fluid, which lubricates its body, and facilitates its paſſage into the ſoil. The inteſtines of this worm are always filled with a fine earth, which ſeems to conſtitute its only nouriſhment. Earth-worms, like ſnails, are hermaphrodite. The parts of generation are placed near the neck, and they mutually impregnate each other. This operation is performed on the ſurface of the ground; and, while thus employed, they will allow themſelves to be cruſhed to pieces rather than part. The females depoſit their eggs in the earth, where they are hatched. Theſe worms, like the polypus, when cut through the middle, reproduce, and each portion becomes a diſtinct individual. According to the different periods of their growth, their colour varies; but, in general, it is a duſky red.

The *ſepia*, or *cuttle-fiſh*, though comparatively a large animal, ſome of them being two feet long, is ranked by Linnaeus under the claſs of *worms*. The ſtructure of the cuttle fiſh is remarkable. Its body is cylindrical, and, in ſome of the ſpecies, is entirely covered with a fleſhy ſheath; in others, the ſheath reaches only to the middle of the body. The ſepia has eight tentacula, or arms, beſide two feelers, as they are called, which are much longer than the arms. Both the feelers and arms are furniſhed with ſtrong cups, or ſuckers, ſhaped like the cup of an acorn, by means of which the animal ſeizes its prey, and firmly attaches itſelf to rocks, or to the bottom of the ſea. It has two large and prominent eyes. What is ſtill more ſingular, it is furniſhed with a hard, ſtrong, horny beak, preciſely ſimilar, both in texture and ſubſtance, to the bill of a parrot. With this bill, the cuttle-fiſh is enabled to break the ſhells of limpets, and other ſhell-animals, upon which it chiefly feeds. In the belly, there is an aperture through which the animal, when purſued by its enemies, emits a fluid as black as ink, tinges the water, and often eſcapes by this ingenious ſtratagem. The ancient Romans frequently uſed this black fluid as ink in writing. The males and females copulate by a mutual embrace. The female depoſits her eggs upon ſea-plants in parcels reſembling bunches of grapes. At the inſtant they drop from the mother, the eggs are white; but the male immediately coats them over with a black liquor. The male perpetually accompanies the female. When the female is attacked, he braves every danger, and often reſcues her at the hazard of his own life. The bone of the cuttle-fiſh is very light, and, when pulverized, it is employed by different artiſts in making moulds.

The *meduſa* is an animal which has the appearance of a lifeleſs maſs of jelly floating on the ſurface of the ocean. Its body is roundiſh, flattened underneath, and the mouth is ſituated in the center of the under part. There are many ſpecies of this ſeemingly moſt imperfect, defenceleſs, and abject part of animated nature. They are, however, furniſhed with tentacula, by which they ſeize inſects and the ſmall fry of fiſhes, convey them to their mouths, and devour them. Although the ſport of the waves, and the prey of every fiſh that approaches them, they are gregarious animals, and, particularly in warm climates, ſometimes collect in ſuch numbers as to have the appearance of whitiſh rocks under the ſurface of the ocean.

We have thus given a ſhort ſketch of the ſtructure of animals, from man down to the inſect tribes, and ſhall now conclude with a few remarks.

In all the variety of animated beings whoſe general ſtructure has been exhibited, the intelligent reader will eaſily perceive, that the bodily forms of the different kinds are exactly adapted to the rank they hold in the creation, and that their oeconomy and manners are ſtrictly and invariably connected with their ſtructure and organs. If a new animal appears, and if its figure be uncommon, it may with ſafety be pronounced, that its manners are equally uncommon. Change the external or internal form of an animal; diminiſh the number of ſtomachs in the ruminating tribes; or give to the horſe a parot's bill; and the ſpecies will be annihilated.

The comparative power, or ſtrength, of animals depends not on ſtructure alone. Mental faculties, and docility, or the capacity of receiving inſtruction, ſeem to be the greateſt ſources of animal power. Hence man's unlimited empire over all other creatures. The inventions of language, of arms, of writing, printing, and engraving, have been the chief means of extending his influence, and of his acquiring the dominion of the earth. By theſe arts, men tranſmit the improvements, the inventions, and the acquiſitions, of one age to another. By theſe arts, the diſpoſitions of men are ſoftened, their manners become more and more civilized, humanity is gradually extended and refined, and the groſſer animoſities yield to external politeneſs and decorum at leaſt, if the feelings themſelves be not blunted. How far this progreſs of ſcience, and the peaceful arts of life, by the accumulation of ages, may proceed, it is impoſſible to determine. But the time, it is to be hoped, is not very remote, when the fiercer contentions of nations will ceaſe, when ſelfiſhneſs and venality, which at preſent ſeem to be inſeparable from commercial ſtates, will give way to generoſity of temper, and uprightneſs of conduct.

CHAPTER III.

Of the Reſpiration of Animals—Air neceſſary to the exiſtence of all animated beings—The various modifications of the organs employed by Nature for the tranſmiſſion of Air into animal bodies.

IT is foreign to the deſign of this chapter to mention the different kinds of air; to unfold its compoſition; or to recapitulate the innumerable benefits derived from it in the animal and vegetable kingdoms, in the arts of life, and in the texture and coheſion of inanimate bodies. For our purpoſe, it is ſufficient to obſerve, that by *air* is meant that common elaſtic fluid which pervades this globe, and which by its weight, its preſſure in all directions, and its compreſſibility, inſinuates itſelf into every vacuity, and is neceſſary to the exiſtence of every animal and vegetable being.

In man, and the larger land animals, air is taken into the body by the lungs. When an animal inſpires, the external air paſſes through the apertures of the mouth and noſe into the trachea or wind-pipe, and thence directly into the lungs. This air, by inſinuating itſelf into the numerous cells of the lungs, neceſſarily inflates them, and, when retained for a ſecond or two, produces an uneaſy ſenſation. To remove this diſagreeable feeling, the animal inſtinctively, by the exertion of particular muſcles deſtined by Nature for that purpoſe, forces out the air, and thus removes the offending cauſe. The lungs, after the air is thrown out, inſtead of being inflated, collapſe; and, if a freſh ſupply is not ſoon taken in, a ſimilar uneaſy ſenſation is felt, which obliges the animal again to inſpire. This alternate reception and rejection of air goes on during the life of the animal, and is diſtinguiſhed by the general name of *reſpiration*. But, when treating more accurately of the ſubject, the act of taking air into the lungs is called *inſpiration*, and the act of throwing it out is termed *expiration*.

That the reſpiration of air is indiſpenſible to the exiſtence of land-animals, has been proved by innumerable experiments made with the air-pump. Mice, rats, rabbits, cats, dogs, &c. when placed in an exhauſted receiver, inſtantly become reſtleſs, and diſcover ſymptoms of pain. Their bodies ſwell, and their life is ſoon extinguiſhed. Indeed, our own feelings are ſufficient to aſcertain this fact. No perſon can remain long either in a ſtate of inſpiration or expiration without being ſuffocated.

But the alternate motions of inſpiration and expiration, joined to the circulation of the blood through the lungs, may be conſidered as the more mechanical effects of reſpiration. Though theſe operations are abſolutely neceſſary to the exiſtence of animals, yet the air itſelf has been ſuppoſed to impart ſome vital principle to the blood, without which life could not be continued.

The ingenious Doctor Crawford, in his treatiſe on Animal Heat, has rendered it probable, that the reſpiration of air is the cauſe of that vital warmth without which no animal can exiſt. After mentioning a well known fact, that all bodies, whether animate or inanimate, contain a certain quantity of fire as a principle in their compoſition, the Doctor remarks, that this quantity, in different bodies,

dies, varies according to their nature or texture; that this fire, when in a latent or quieſcent ſtate, is termed *abſolute heat;* that, when ſubſtances of different textures have a given quantity of heat thrown into them, their temperature will be diſcovered to be different by the thermometer; for the ſame quantity of heat which raiſes one body to a certain degree, will raiſe another to a greater or a leſs; and this different diſpoſition of bodies is called their capacity of containing abſolute heat.

Doctor Crawford next endeavours to prove by experiments, that, when phlogiſton is added to any body, its capacity of containing abſolute heat is diminiſhed; and that, when phlogiſton is abſtracted from the ſame body, its capacity of receiving abſolute heat is augmented. Hence he infers, that heat and phlogiſton ſeem to conſtitute two oppoſite principles in nature By the action of heat upon bodies, the force of their attraction to phlogiſton is diminiſhed; and, by the action of phlogiſton, a part of the abſolute heat, which exiſts in every ſubſtance as an element, is expelled. ‘ Hence,’ ſays the Doctor, ‘ animal heat ſeems to depend upon a proceſs ſimilar to ‘ a chemical elective attraction. The air is received into the lungs, ‘ containing a great quantity of abſolute heat. The blood is re‘turned from the extremities, highly impregnated with phlogiſton. ‘ The attraction of the air to the phlogiſton is greater than that of ‘ the blood. This principle will therefore leave the blood to com‘bine with the air. By the addition of the phlogiſton, the air is ‘ obliged to depoſit a part of its abſolute heat; and, as the capacity ‘ of the blood is, at the ſame moment, increaſed by the ſeparation ‘ of the phlogiſton, it will inſtantly unite with that portion of heat ‘ which had been detached from the air.

‘ We learn from Doctor Prieſtley’s experiments with reſpect to ‘ reſpiration, that arterial blood has a ſtrong attraction to phlogiſton:

‘ It will, conſequently, during the circulation, imbibe this principle ‘ from thoſe parts which retain it with the leaſt force, or from the ‘ putreſcent parts of the ſyſtem: And hence the venous blood, when ‘ it returns to the lungs, is found to be highly impregnated with ‘ phlogiſton. By this impregnation, its capacity for containing heat ‘ is diminiſhed. In proportion, therefore, as the blood, which had ‘ been dephlogiſticated by the proceſs of reſpiration, becomes again ‘ combined with phlogiſton, in the courſe of the circulation, it will ‘ gradually give out that heat which it had received in the lungs, ‘ and diffuſe it over the whole ſyſtem *.’

The Doctor afterwards proceeds to aſſign a reaſon why the heat of animals is always equal. ‘ As animals,’ ſays he, ‘ are continually abſorbing heat from the air, if there were not a quantity of ‘ heat carried off, equal to that which is abſorbed, there would be an ‘ accumulation of it in the animal body. The evaporation from ‘ the ſurface, and the cooling power of the air, are the great cauſes ‘ which prevent this accumulation. And theſe are alternately increaſed and diminiſhed, in ſuch a manner as to produce an equal ‘ effect. When the cooling power of the air is diminiſhed by the ‘ ſummer heats, the evaporation from the ſurface is increaſed; and ‘ when, on the contrary, the cooling power of the air is increaſed ‘ by the winter colds, the evaporation from the ſurface is proportionally diminiſhed †.’

This theory, though not ſupported by mathematical evidence, is not only ingenious, but ſeems to make a nearer approach to truth than any that has hitherto been invented ‡.

Reſpiration,

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* Crawford on Animal Heat, pag. 73. † Ibid. pag. 84.

‡ If the reader is deſirous of ſeeing ſome pertinent remarks on Doctor Crawford's Theory

Reſpiration, beſide being the probable cauſe of the equable continuation of heat in animals, produces many other ſalutary and uſeful effects in the oeconomy of animated bodies. There is a moſt intimate connection between the act of reſpiring and the circulation of the blood. When reſpiration is, for a ſhort time, interrupted by the fumes of burning ſulphur, by mephitic air, or by remaining ſome minutes under water, the action of the heart ceaſes. But, in many caſes of this kind, the motion of the heart may, and frequently has been renewed, by blowing air into the lungs, and by the application of ſtimulating ſubſtances to different organs of the body. In perſons ſeemingly dead from a temporary ſuſpenſion of reſpiration, if the lungs can be excited to act, the motion of the heart inſtantly commences, the circulation of the blood is reſtored, and life is recovered. This intimate connection between reſpiration and the action of the heart, is one of thoſe aſtoniſhing facts in the animal oeconomy, the cauſes of which will perhaps forever elude the keeneſt reſearches of the human intellect. All we know is, that certain functions are indiſpenſible to the exiſtence of animals, and that, if any of them are ſuſpended for a few ſeconds, life is extinguiſhed; namely, the action of the brain and nerves, the circulation of the blood, reſpiration, and a probable reſult of reſpiration, animal heat. Theſe functions, from their importance in the ſyſtem, have received the appellation of *vital functions*. There are other functions of the body, called *natural*, which are no leſs neceſſary to life, as the digeſtion and concoction of aliment, the various ſecretions and excretions. But they are diſtinguiſhed from the vital functions, becauſe ſome of them may be ſuſpended for a conſiderable time without materially injuring the body.

Theory of Animal Heat, he may conſult Doctor Gardiner's *Obſervations on the Animal Oeconomy, and on the Cauſes and Cure of Diſeaſes*, an ingenious and uſeful performance, lately publiſhed, and which merits much more attention from Philoſophers and Phyſicians than it has hitherto received.

Reſpiration commences inſtantly after birth, and is inſtinctively continued during life. In the foetus ſtate, as formerly mentioned *, reſpiration is unneceſſary, becauſe the circulation of the general maſs of blood is carried on through a different channel. In the act of inſpiration, we are conſcious of making a certain effort; but in the act of expiration we ſcarcely perceive any exertion whatever.

Beſide the circulation of the blood, and the continuation of the vital warmth, reſpiration gives riſe to many other important functions in the animal oeconomy. All animals who reſpire, beſide a watery vapor, exhale great quantities of mephytic or corrupted effluvia, which, if retained in the lungs, or breathed by other animals, would ſoon prove fatal. The muſcles of reſpiration, of which we have the command, are employed in many other operations of the body, beſide the mere act of breathing air. All animals furniſhed with lungs expreſs their wants, their affections and averſions, their pleaſures and pains, either by words, or by ſounds peculiar to each ſpecies. Theſe different ſounds are produced by ſtraitening or widening the glottis and wind-pipe, or, in general, the paſſage through which the air paſſes in reſpiration. The inferior animals are by this means enabled to expreſs themſelves, though not by articulate ſounds, in ſuch a manner as to be perfectly intelligible to every individual of a ſpecies. On man alone, Nature has beſtowed the faculty of ſpeaking, or of expreſſing his various feelings and ideas, by a regular, extenſive, and eſtabliſhed combination of articulate ſounds. To have extended this faculty to the brute creation, would not, it is probable, have been of any uſe to them; for, though ſome animals can be taught to articulate, yet, from a defect in their intellect, none of them ſeem to have any idea of the proper meaning of the words they utter. Speech is performed by a very various and

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* See above, page 66.

and complicated machinery. In ſpeaking, the tongue, the lips, the jaws, the whole palate, the noſe, the throat, together with the muſcles, bones, &c. of which theſe organs are compoſed, are all employed. This combination of organs we are taught to uſe when ſo young that we are hardly conſcious of the laborious taſk, and far leſs of the manner by which we pronounce different letters and words. The mode of pronouncing letters and words, however, may be learned by attentively obſerving the different organs employed by the ſpeaker. By this means we are enabled to correct various defects of ſpeech, and even to teach the dumb to ſpeak; for dumbneſs is ſeldom the effect of imperfection in the organs of ſpeech, but generally ariſes from a want of hearing; and it is impoſſible for deaf men to imitate ſounds which they never heard, except they be taught to uſe their organs by viſion and by touching.

When about to laugh, we make a very full inſpiration, which is ſucceeded by frequent, interrupted, and ſonorous expirations. When the titillation is great, whether it ariſes from the mind or body, theſe convulſive expirations ſometimes interrupt the breathing to ſuch a degree as to endanger ſuffocation. Moderate laughing, on the contrary, promotes health: By agitating the whole body, it quickens the circulation of the blood, gives an inexpreſſible chearfulneſs to the countenance, and baniſhes every kind of anxiety from the mind.

In weeping, we employ nearly the ſame organs as in laughing. It commences with a deep inſpiration, which is ſucceeded by ſhort, broken, ſonorous, and diſagreeable expirations. The countenance has a diſmal aſpect, and tears are poured out. Weeping originates from grief, or other painful ſenſations either of body or mind: When full vent is given to tears, grief is greatly alleviated. Both laughing and weeping have been reckoned peculiar to man. But this notion ſeems not to be well founded. Though the other animals expreſs not their pleaſures or pains in the ſame manner as we do, yet all of them exhibit their pleaſant or painful feelings by ſymptoms or cries, which are perfectly underſtood by the individuals of each ſpecies, and, in many inſtances, by man. A dog, when hurt, complains in the bittereſt terms; and, when he is afraid, or perhaps melancholy, he expreſſes the ſituation of his mind by the moſt deplorable howlings. A bird, when ſick, ceaſes to ſing, droops the wing, abſtains from food, aſſumes a lurid aſpect, utters melancholy, weak cries, and exhibits every mark of depreſſed ſpirits. By this means, animals intimate the aſſiſtance they require, or ſoften thoſe who maltreat them. Their plaintive cries are ſometimes ſo affecting as to diſarm their enemies, or procure the aid of their equals. On the other hand, when animals are pleaſed or careſſed, they diſcover, by their countenance, by their voice, by their movements, unequivocal ſymptoms of chearfulneſs and alacrity of mind. Thus the expreſſions of pleaſure and pain by brute animals, though not uttered in the preciſe manner with thoſe of the human ſpecies, are perfectly analogous, and anſwer the ſame intentions of Nature.

By reſpiration, and the inſtruments employed in the performance of it, the larger animals are not only brought forth, but are enabled to extract milk from the breaſts of the mother. By reſpiration, odors are conveyed to the noſe; coughing, ſneezing, yawning, ſighing, ſinging, vomiting, and many other functions in the animal oeconomy, are at leaſt partly accompliſhed.

After this general view of the reſpiration of man and of quadrupeds, we proceed, according to the method laid down, to give ſome account of the ſame function in the other claſſes of animals.

With regard to BIRDS, though, like other land-animals, they reſpire by means of lungs, Nature has enabled them to tranſmit air to almoſt every part of their bodies. The lungs of birds are ſo firmly attached to the diaphragm, the ribs, the ſides, and the vertebrae, that they can admit of very little dilatation or contraction. Inſtead of being impervious, the ſubſtance of the lungs, as well as of the diaphragm, to which they adhere, is perforated with many holes or paſſages for the tranſmiſſion of air to the other parts of the body *. To each of theſe perforations a diſtinct membranous bag is joined. Theſe bags are extremely thin and tranſparent. They extend through the whole of the abdomen, are attached to the back and ſides of that cavity, and each of them receives air from their reſpective openings into the lungs. The cells in birds which receive air from the lungs are found not only in the ſoft parts, but in the bones. That ingenious and accurate anatomiſt, Mr John Hunter of London, remarks, that the bones of birds which receive air are of two kinds: 'Some, as the ſternum, ribs, and vertebrae, have their internal ſubſtance divided into innumerable cells, whilſt others, as the 'os humeri and the os femoris, are hollowed out into one large canal, with ſometimes a few bony columns running acroſs at the extremities. Bones of this kind may be diſtinguiſhed from thoſe 'that do not receive air by certain marks: 1. By their leſs ſpecific 'gravity: 2. By being leſs vaſcular, and therefore whiter: 3. By 'their containing little or no oil, and conſequently being more eaſily cleaned; and, when cleaned, appearing much whiter than common bones: 4. By having no marrow, or even any bloody pulpy 'ſubſtance in their cells: 5. By not being, in general, ſo hard and 'firm as other bones; and, 6. By the paſſage that allows the air to 'enter the bones, which can eaſily be perceived. In the recent 'bone we may readily diſcover holes, or openings, not filled with 'any ſuch ſoft ſubſtance as blood-veſſels or nerves; and it happens 'that

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* This fact ſeems to have been firſt mentioned by the celebrated Doctor Harvey. See Harvey de Generat. Animal. Exercit. 3.

'that ſeveral of theſe holes are placed together, near that end of the 'bone which is next to the trunk of the bird; and are diſtinguiſh'able by having their external edges rounded off; which is not the 'caſe with the holes through which either nerves or blood-veſſels 'paſs into the ſubſtance of the bone *.'

Mr Hunter afterwards informs us, that the lungs, at the anterior part, open into a number of membranous cells, which lie upon the ſides of the pericardium, and communicate with thoſe of the ſternum. At the ſuperior part, the lungs open into the large cells of a looſe net-work, through which the wind-pipe, gullet, and large veſſels, paſs as they proceed to and from the heart. These cells, when diſtended with air, augment conſiderably the part where they are ſituated; and this augmentation, or ſwelling, is generally a mark either of anger or of love. This tumefaction is remarkable in the turkey-cock, in the pouting pigeon, and in the breaſt of a gooſe when ſhe cackles. Theſe cells communicate with others in the axilla, under the large pectoral muſcle. In moſt birds, the axillary cells communicate with the cavity of the os humeri by ſmall openings in the hollow ſurface near the head of that bone. In ſome birds, theſe cells are continued down the wing, and communicate with the ulna and radius; in others, they extend even to the pinions. The poſterior edges of the lungs open into the cells of the vertebrae, into thoſe of the ribs, the canal of the ſpinal marrow, the ſacrum, and other bones of the pelvis; from theſe parts the air finds a paſſage into the thigh-bone. 'Thus,' continues our learned and indefatigable author, 'the cells of the abdomen, thoſe ſurrounding 'the pericardium, thoſe ſituated at the lower and forepart of the 'neck, and in the axilla, thoſe in the cellular membrane under the 'pectoral muſcles, as well as in that which unites the ſkin to the 'body,

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* Hunter's Obſervations on certain parts of the Animal Oeconomy, pag. 79.

'body, all communicate with the lungs, and are capable of being 'filled with air; and again from theſe the cells of the ſternum, ribs, 'vertebrae of the back and loins, bones of the pelvis, the humeri, 'the ulna and radius, with the pinions and thigh-bones, can in many 'birds be furniſhed with air [*].'

Theſe facts, which our author candidly acknowledges had been formerly obſerved, led him, in the year 1758, to make experiments on the breathing of birds, in order to prove the free communication between the lungs and the ſeveral parts of the body mentioned above.

'First,' ſays he, 'I made an opening into the belly of a cock, 'and having introduced a ſilver canula, tied up the trachea; I found 'that the animal breathed by this opening, and might have lived; 'but, by an inflammation in the bowels coming on, adheſions were 'produced, and the communication cut off.

'I next cut the wing through the os humeri, in another fowl, 'and tying up the trachea, as in the cock, found that the air paſſed 'to and from the lungs by the canal in this bone. The ſame experiment was made with the os femoris of a young hawk, and was 'attended with nearly the like ſucceſs [†].'

The extreme ſingularity of this almoſt univerſal diffuſion of air through the bodies of birds, naturally excited a deſire to diſcover what might be the intention of Nature in producing a ſtructure ſo extraordinary. Mr Hunter firſt imagined that it might be intended to aſſiſt the act of flying, by increaſing the volume and ſtrength of the

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[*] Hunter's Obſervations on certain parts of the Animal Oeconomy, pag. 81.

[†] Ibid. pag. 82.

the animal, without adding to its weight, which muſt be diminiſhed; becauſe the ſpecific gravity of the external air is ſuperior to that of the internal air, which is rendered more rare by the heat of the animal's body. This opinion was corroborated, by conſidering that the feathers of birds, and particularly thoſe of the wings, contain a great quantity of air. With his uſual ingenuouſneſs, however, Mr Hunter, in oppoſition to his firſt conjecture, informs us, that the oſtrich, which does not fly, was amply provided with air-cells diſperſed through its body; that the wood-cock, and ſome other flying birds, were not ſo liberally ſupplied with theſe cells as the oſtrich; and that the bat had no ſuch peculiarity of ſtructure. With regard to the oſtrich, though it is not intended to fly, it runs with amazing rapidity, and, conſequently, requires ſimilar reſources of air.

He next conjectured, from analogy, that the air-cells in birds ought to be conſidered as an appendage to the lungs; becauſe in the ſnake, viper, and ſeveral other amphibious animals, the lungs are continued, in the form of two bags, through the whole abdomen, the upper part of which can only perform the office of reſpiration with any degree of effect; becauſe the lower part has comparatively few air-veſſels. 'The air,' ſays Mr Hunter, 'muſt paſs through 'this upper part before it gets to the lower in inſpiration, and muſt 'alſo repaſs in expiration; ſo that the reſpiratory ſurface has more 'air applied to it than what the lungs of themſelves could contain. 'There is, in fact, a great ſimilarity between birds and that claſs of 'animals called *amphibious;* and, although a bird and a ſnake are 'not the ſame in the conſtruction of the reſpiratory organs, yet the 'circumſtance of the air paſſing in both beyond the lungs, into the 'cavity of the abdomen, naturally leads us to ſuppoſe, that a ſtructure ſo ſimilar is deſigned in each to anſwer a ſimilar purpoſe. This 'analogy is ſtill farther ſupported by the lungs in both conſiſting of 'large cells. Now, in amphibious animals, the uſe of ſuch a con-

'formation of lungs is evident; for it is in conſequence of this 'ſtructure that they require to breathe leſs frequently than others. 'Even conſidering the matter in this light, it may ſtill, in birds, 'have ſome connection with flying, as that motion may eaſily be 'imagined to render frequency of reſpiration inconvenient, and a 'reſervoir of air may therefore become ſingularly uſeful. Although 'we are not to conſider this ſtructure in birds to be an extenſion of 'lungs, yet I can eaſily conceive this accumulation of air to be of 'great uſe in reſpiration; for, as we obſerved in the viper, that the 'air, in its paſſage to and from theſe cells, muſt certainly have a 'conſiderable effect upon the blood in the lungs, by allowing a much 'greater quantity of air to paſs in a given time, than if there was 'no ſuch conſtruction of parts. And this opinion will not appear 'to be ill founded, if we conſider, that, both in the bird and the viper, the ſurface of the lungs is ſmall in compariſon to what it is 'in many other animals which have not this extenſion of cavity.— 'We muſt not, however, give up the idea of ſuch ſtructure being 'of uſe in flying; for I believe we may ſet it down as a general 'rule, that, in the birds of longeſt and higheſt flight, as eagles, this 'extenſion, or diffuſion of air, is carried farther than in the others; 'and this opinion is ſtrengthened, by comparing this ſtructure with 'the reſpiratory organs in the flying inſects, which are compoſed of 'cells diffuſed through the whole body; and theſe are extended 'even into the head and down the extremities, while there is no 'ſuch ſtructure in thoſe that do not fly, as the ſpider,' &c.

Though Mr Hunter's modeſty has not permitted him to draw his concluſion in a poſitive manner, he ſeems to have proved decidedly, that one uſe of the general diffuſion of air through the bodies of birds is to prevent their reſpiration from being ſtoped or interrupted by the rapidity of their motion through a reſiſting medium. The reſiſtence of the air increaſes in proportion to the celerity of the

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motion. Were it poſſible for man to move with a ſwiftneſs equal to that of a ſwallow, the reſiſtance of the air, as he is not provided with internal reſervoirs ſimilar to thoſe of birds, would ſoon ſuffocate him. Neither does the difficulty he mentions, with regard to the ſtructure of the oſtrich, ſeem to contradict his theory; for though, as formerly remarked, the oſtrich does not fly, he runs with aſtoniſhing rapidity.

The reſpiration of air is not only neceſſary to the exiſtence of land-animals, but to that of FISHES of every denomination. Coetaceous fiſhes, or thoſe of the whale-kind, reſpire, like man and quadrupeds, by means of lungs; and, of courſe, they are obliged, at certain intervals, to come to the ſurface, in order to throw out the former air, and to take in a freſh ſupply.

Inſtead of lungs, the other ſpecies of fiſhes are furniſhed with gills, through which they reſpire both water and air; for air is univerſally diffuſed or mixed with every portion of water. When a free communication with the external air is prevented by ice, or by artifice, fiſhes immediately diſcover ſymptoms of uneaſineſs, and ſoon periſh. Ælian informs us, that, in winter, when the river Iſter was frozen, the fiſhers dug holes in the ice; that great numbers of fiſhes reſorted to theſe holes; and that their eagerneſs was ſo great, that they allowed themſelves to be ſeized by the hands of the fiſhermen. Rondeletius made many experiments on this ſubject. If, ſays he, fiſhes are put into a narrow-mouthed veſſel filled with water, and a communication with the air be preſerved, the animals live, and ſwim about, not for days and months only, but for ſeveral years. If the mouth of the veſſel, however, be ſo cloſely ſhut, either with the hand, or any other covering, that the paſſage of the air is excluded, the fiſhes ſuddenly die. Immediately after the mouth of the veſſel is cloſed, the creatures ruſh tumultuouſly, one above another,

other, to the top, contending which of them ſhall ſooneſt receive the benefit of the air *. In the ſhallow parts of rivers, when frozen, many fiſhes are found dead. But, when parts of a river are deep or rapid, the fiſhes fly from the ice, and by this means avoid deſtruction.

Theſe, and ſimilar experiments, have been repeated by Mr Willoughby, and many other modern authors; and they have uniformly been attended with the ſame event. A carp, in a large veſſel full of water, was placed in the receiver of an air-pump. In proportion as the air was exhauſted by working the pump, the ſurface of the animal's body was covered with a number of bubbles. The carp ſoon breathed quicker, and with more difficulty: A little after, it roſe to the ſurface in queſt of air. The bubbles on its ſurface next diſappeared; the belly, which before was greatly ſwollen, ſuddenly collapſed; and the animal ſunk to the bottom, and expired in convulſions.

Thus the reſpiration of air is as neceſſary to the exiſtence of fiſhes as to that of land-animals; for none of them can live long when deprived of this vivifying element. Fiſhes, indeed, ſeem to require a ſmaller quantity of air than animals who have a conſtant and free communication with the atmoſphere. The bodies and fluids of fiſhes are colder than thoſe of land-animals; and, of courſe, if Doctor Crawford's theory be well founded, fiſhes require leſs air to ſupport the proportionally ſmall quantity of heat they poſſeſs.

An analogy between fiſhes and birds deſerves here to be noticed. Both of theſe claſſes of animals are rapid in their motions; and both of them, beſide reſpiring by lungs or gills, have receptacles of air within their bodies. Fiſhes tranſmit ſmall quantities of air through their

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* Rondeletius, lib. 4. cap. 9.

their gills; but Nature has provided moſt of them with air-bags or bladders, which may anſwer the double purpoſe, of enabling them to aſcend and deſcend in the water, and to communicate a vital principle to their whole ſyſtem.

We ſhall conclude this ſubject with an account of the modes employed by Nature for tranſmitting air into the bodies of INSECTS.

In this ſeemingly contemptible, and often noxious claſs of animals, Nature has exhibited a wonderful diverſity of form, of manners, of inſtincts, of deformity, and of beauty. But, however inſignificant theſe creatures may appear to inattentive obſervers, Nature has been equally provident in the formation of their bodies, and in the means of preſerving the different individuals, according to their kinds, as in the larger animals, which have the appearance of more importance in the ſcale of being. To inſects ſhe has denied lungs ſimilar to thoſe of men, quadrupeds, birds, and fiſhes; but, as the tranſmiſſion of air into their bodies was neceſſary to continue the principle of life, ſhe has furniſhed them with peculiar inſtruments and apparatus for accompliſhing this indiſpenſible purpoſe.

Air is conveyed into the bodies of inſects by inſtruments called *tracheae* or *ſtigmata*. The tracheae, or wind-pipes, are, in many inſects, long tubes protruding externally from different parts of the body. In ſome, they proceed from the poſterior part, and have the appearance of one, two, or three tails; in others, they ariſe from the back or ſides. The *ſtigmata* are ſmall holes, generally of a different colour from the reſt of the body, and run along the ſides of many caterpillars in regular and beautifully dotted lines. That theſe tracheae and ſtigmata are deſtined for the tranſmiſſion of air, has been proved by repeated experiments; for, when ſtopped up by the application of oil, or other unctuous ſubſtances, the animals ſoon loſe their exiſtence.

In contemplating the parts of animals, when the uſes of theſe parts are not apparent, we are apt to deceive ourſelves by raſhly ſuppoſing them to anſwer purpoſes for which they were never intended by Nature. Impreſſed with this idea, M. de Reaumur was not ſatisfied with the notion of Goedart and others, that the long tails of certain worms were intended to keep them ſteady in their motions, and to prevent them from rolling. Reaumur obſerved, that theſe worms or grubs could lengthen or ſhorten their tails at pleaſure, but that they were always longer than the animal's body. Becauſe theſe tails have ſome reſemblance to that of a rat, he diſtinguiſhes the animals by the name of *rat-tailed worms*. Theſe worms are aquatic, and never appear on dry ground till they are about to undergo their firſt transformation. Reaumur, in order to obſerve their oeconomy more cloſely, collected a number of rat-tailed worms, and put them into a glaſs veſſel filled two inches high with water. At firſt they were conſiderably agitated, each ſeemingly ſearching for a proper place of repoſe. Some of them ſwam acroſs, others attached themſelves to the ſides, and others reſted at the bottom of the veſſel. In a quarter of an hour they were almoſt entirely tranquil, and Reaumur ſoon diſcovered the real uſe of their long tails. Upon examining the veſſel, he found that each of the animals, in whatever ſituation they were placed, extended its tail exactly to the ſurface; that, like other aquatic inſects, the reſpiration of air was neceſſary to their exiſtence; and that the tail, which is tubular, and open at the extremity, was the organ by which this operation was performed. In this experiment, the diſtance from the bottom to the ſurface was two inches, and, of courſe, the tails were of an equal length. To diſcover how far the animals could extend their tails, this moſt ingenious and indefatigable philoſopher gradually augmented the height of the water, and the tails uniformly roſe to the ſurface till it was between five and ſix inches high. When the water was raiſed higher, the animals immediately quitted their ſtation at the bottom, and either mounted higher in the water, or fixed upon the ſides of the veſſel, in ſituations which rendered it convenient for them to reach the ſurface with the points of their tails. Theſe tails conſiſt of two tubes, both of which are capable of extenſion and contraction. The firſt tube is always viſible; but the ſecond, which is the proper organ of reſpiration, is exſerted only when the water is raiſed to a certain height. Through this tube the air is conveyed into two large tracheae or wind-pipes within the body of the animal, and maintains the principle of life. When the tails are below the ſurface, they occaſionally emit ſmall bubbles of air, which are viſible to the naked eye; and immediately repair to the ſurface for freſh ſupplies. Theſe rat-tailed worms paſs the firſt and longeſt part of their lives under water; when near the time of their transformation, they leave the water, go under the ground, and are there transformed into chryſalids; and, laſtly, from this ſtate they are transformed into flies, and ſpend the remainder of their exiſtence in the air.

Another ſpecies of aquatic worms merit attention. They frequent marſhes, ditches, and ſtagnating waters. Their general colour is a greeniſh brown. Their bodies conſiſt of eleven rings; and their ſkin is not cruſtaceous, but rather reſembles parchment. Though theſe animals, before their transformation into flies, live in water, air is neceſſary to ſupport their principle of life; and the apparatus with which Nature has furniſhed them for that important purpoſe deſerves our notice. The laſt ring, or termination of their bodies, is open, and ſerves as a conductor of air. From this laſt ring proceed a number of hairs, which, when examined by the microſcope, are found to be real feathers with regular vanes. In particular ſituations, they bend the laſt ring in ſuch a manner as to reach the ſurface of the water or mud in which they are placed. Theſe feathers prevent the water from entering into the tube, or organ of reſpiration; and, when the animal raiſes the termination of its body to the ſurface, in order to receive air, it erects and ſpreads the feathers, and by this means expoſes the end of the tube to the atmoſphere. When cautiouſly cut open, two large veſſels, or tracheae, appear on each ſide, and occupy almoſt one half of the body. Both of theſe wind-pipes terminate in the open tube, or laſt ring. Though theſe worms are furniſhed with organs of reſpiration, and actually reſpire air, yet M. de Reaumur diſcovered that ſome of them could live more than twenty-four hours without reſpiration.

So anxious is Nature to provide animals, in every ſtate of their exiſtence, with air, that, after the transformation of many inſects into chryſalids, ſhe creates inſtruments for that purpoſe, which did not exiſt previous to their transformation. The rat-tailed worms, formerly mentioned, ſoon after they are transformed into chryſalids, inſtead of a ſoft pliable ſkin, are covered with a hard cruſtaceous ſubſtance, ſeemingly impervious to the air; and the tail, which was the wind-pipe of the animal in its firſt ſtate, gradually vaniſhes. In a few hours, however, four hollow horns ſhoot out, two from the fore, and two from the hind, part of what was the head of the animal. Theſe horns, which are hard and tubular, M. de Reaumur diſcovered to be real wind-pipes, deſtined for the introduction of air into the chryſalis, a ſtate in which the animals have the appearance of being almoſt totally dead, and, of courſe, ſhould ſeem to have little uſe for reſpiration. He likewiſe diſcovered that theſe horns, which had pierced the hard exterior covering, terminated in as many tracheae in the body of the animal. This fact affords a ſtrong example of the neceſſity of air for ſuſtaining the principle of life, even in its loweſt condition. After theſe animals paſs from the chryſalis ſtate to that of flies, they are deprived both of their tails and horns.

But Nature, in this laſt ſtage of their exiſtence, has not left them without proper reſources for the introduction of air into their bodies. Inſtead of protuberant tracheae in the form of tails or horns, they now, like other flies, receive air by means of ſtigmata, or holes, variouſly diſpoſed over different parts of the body.

The nymph of the libella, or dragon-fly, reſpires water, in the ſame manner as men and quadrupeds reſpire air. We receive and throw out the air by the mouth and noſtrils. But the nymphs of the libella receive and eject water by an aperture at the termination of their bodies. Theſe nymphs ſometimes throw out the water, at certain intervals, with ſuch force, that the ſtream is perceptible at the diſtance of two or three inches from their bodies. When kept ſome time out of the water, the deſire or neceſſity of reſpiration is augmented; and, accordingly, when replaced in a veſſel filled with water, inſpirations and reſpirations are repeated with unuſual force and frequency. If you hold one of theſe nymphs in your hand, and apply drops of water to the poſterior end of its body, it inſtantly, by an apparatus ſimilar to the piſton of a pump, ſucks in the water, and the dimenſions of its body are viſibly augmented. This water is again quickly thrown out by the ſame inſtrument. But, though this inſect reſpires water, air ſeems to be not the leſs neceſſary to its exiſtence; for, like other inſects, the whole interior part of its body is amply provided with large and convoluted tracheae; and, externally, there are ſeveral ſtigmata deſtined for the introduction of air *.

The worms, or nymphs, of the ephemeron flies merit attention. They have received the denomination of *ephemeron*, becauſe almoſt none of them ſurvive the day in which they are transformed into flies. But many of them live not one hour after their transformation. When in the worm and nymph ſtates, they generally live in holes near the ſurface of the water; and, under theſe two forms, continue to grow till they are mature for paſſing into the laſt and ſhorteſt period of their exiſtence. Swammerdam informs us, that ſome of them remain three years under water, others two, and others one only. During their abode in this element, they are nouriſhed and prepared for their laſt and fatal change. Immediately after the males have joined their mates, and the females have depoſited their eggs in the water, both periſh, but not before they have left the rudiments of a numerous race of ſucceſſors. As long as theſe inſects live in the water, to inattentive obſervers, their general appearance is nearly the ſame. When they have paſſed, however, into nymphs, the veſtiges of wings may be perceived, which we look for in vain during their firſt or worm ſtate. In both ſtates, the inſect which is to become an ephemeron fly has ſix legs attached to the breaſt. The head is triangular, and from the baſe of each eye proceeds an articulated feeler. The body is compoſed of ten rings, from the laſt of which three tails, that probably perform the office of tracheae, ariſe. Theſe tails, in ſome ſpecies, are as long as the animal's body, and are fringed with hairs which have a reſemblance to feathers. But, what principally deſerves our notice on this ſubject is, that, on each ſide of the body, there are ſix or ſeven protuberances, which have the appearance of ſo many oars. With theſe inſtruments the animals deſcribe arches in the water, firſt on one ſide, and then on the other, with aſtoniſhing rapidity. This circumſtance led Clutius, and ſome other authors, to think that theſe protuberances were fins, or inſtruments of motion, and that the animals were fiſhes. But Reaumur remarked that they moved theſe fins with the ſame rapidity when the animals were at reſt as when they were in motion; and that, inſtead of fins, when examined by the microſcope, he diſcovered them to be gills, through which the creatures reſpire. Each gill conſiſts of a ſhort trunk, and two large branches, or tubes, which give off on all ſides a number of ſmaller ramifications, and are perfectly ſimilar to the tracheae of other inſects. At the origin of every gill, two tracheae penetrate the trunk, and are diſperſed through the body of the animal.

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* Reaumur, tom. 12. pag. 187. 12° edit.

Though the ſtigmata, or reſpiratory organs, of caterpillars and other inſects, were long known to ſerve the purpoſe of inſpiration, yet it was uncertain whether the animals reſpired by the ſame orifices, till Bonnet, and, after him, Reaumur, aſcertained the fact by many curious and accurate experiments. The firſt of theſe authors immerſed numbers of caterpillars, of different kinds, and at different times, in water, and he obſerved, both with the naked eye, and by the aſſiſtance of a glaſs, bubbles of air iſſuing from various parts of their bodies, and particularly from the ſtigmata. To remove all deception from his experiments, before immerſion, he carefully moiſtened the caterpillars with water, in order to diſlodge any portions of the external air that might be adhering to their bodies. Some of them he allowed to remain ſo long under water, that they had every appearance of death. He then raiſed the head and the two anterior ſtigmata above the ſurface. The head, and firſt pair of legs, ſoon began to move from ſide to ſide; and the body neceſſarily partook of the ſame motions. During theſe movements, many bubbles of air iſſued from the poſterior and intermediate ſtigmata, which ſtill remained under water; but the membranous limbs continued nearly at reſt. He next kept a caterpillar under water till all motion was ſuſpended. Then he elevated the anus and the two laſt ſtigmata above the ſurface, that they might have a communication with the external air. He kept the animal in this ſituation about half an hour, without any ſymptoms of re-animation. After raiſing the body ſucceſſively from the laſt to the firſt pair of ſtigmata, ſtill the animal exhibited no ſymptoms of life; but, when he expoſed the whole body to the external air for half an hour, the powers of life completely returned. After ſuſpending the caterpillar about two hours with the laſt five pair of ſtigmata above the ſurface, he found that life was not extinguiſhed. He then raiſed the water till the anus and laſt pair of ſtigmata only were expoſed to the atmoſphere. He allowed the caterpillar to remain in this ſituation more than half an hour; and he obſerved that it often bended its body with a view to reach the ſurface, and that, during theſe efforts, bubbles of air iſſued from the anterior, but not from the poſterior ſtigmata. He likewiſe remarked, that, on the ſmalleſt motion of the animal, theſe bubbles were diſcharged, but that they were augmented both in quantity and ſize, in proportion to the agitations of the body. M. Bonnet immediately raiſed the water till it covered the two laſt ſtigmata; the caterpillar was violently agitated; but no bubbles of air, the communication being cut off, appeared, and all motion ceaſed. He inſtantly lowered the water, and expoſed the two poſterior ſtigmata to the air; the animal reſumed its movements; but in a moment after it expired. By another experiment, M. Bonnet diſcovered that a caterpillar lived eight days ſuſpended in water, during all which time it breathed ſolely by the two poſterior ſtigmata.

After theſe, and many other facts of a ſimilar kind, which demonſtrate that air is neceſſary for the ſupport and continuation of animal life, it ſhall only be remarked, that, when caterpillars undergo their laſt change, and appear in the form of flies of every denomination, Nature has ſtill furniſhed them with ſtigmata, or reſpiratory organs.

Reptiles of all kinds are likewiſe furniſhed with organs of reſpiration. Land-ſnails, at the approach of winter, bury themſelves in the earth, or retire into holes of rocks, or of old buildings, where they remain in a torpid ſtate during the ſeverity of the ſeaſon. For protection and warmth, theſe animals, when they go into their winter habitations, form, by means of a ſlime or ſaliva that iſſues from every pore of their bodies, a membranous cover which ſtops up the mouths of their ſhells. But this pellicle or cover, though apparently pretty hard and ſolid, is ſo thin and porous as not entirely to exclude the entrance of air, without which the principle of life could not be continued. Accordingly, when, by accident, the pellicle is made too thick, and prevents a communication with the external air, the animal, to remedy the evil, makes a ſmall aperture in its cover. In this ſtate ſnails remain ſix or ſeven months, without food or motion, till the genial warmth of the ſpring breaks their ſlumber, and calls forth their active powers. Hence it ſhould appear, that air is more neceſſary to the preſervation of animal life than food itſelf; for, in numberleſs inſtances, animals can live, not for days or weeks, but for months, without ſupplies of nouriſhment. None of them, however, are capable of exiſting nearly ſo long without having ſome communication with the air.

With regard to ſnails that live in freſh waters, or in the ocean, the ſpecies of which are numerous, their manner of reſpiring is ſingular. All of them have an aperture on the right ſide of the neck. This aperture ſerves the complicated purpoſes of diſcharging the faeces, of lodging the organs of generation, of aſcending and deſcending in the water, and of reſpiration. They are frequently obſerved to ſtraiten the orifice of this aperture, to ſtretch it out in the form of an oblong tube; and, in this ſtate, they riſe to the ſurface, in order to expel the former air, and take in a new ſupply.

But, though air ſeems to be an indiſpenſible principle of animal life, yet many animals can live longer without the uſe of this element, or at leaſt with ſmaller quantities of it, than others. Even men, by long practice, acquire the faculty of retaining the air in their lungs for an almoſt incredible length of time. Some of thoſe wretched creatures who are compelled by tyranny to dive for pearl-oyſters, have been known to continue under water three quarters of an hour without receiving a freſh ſupply of air. Thoſe animals which lie torpid during the winter, as the hedge-hog, the dormouſe, the marmot, &c. though perhaps not entirely deprived of all communication with the air, exiſt, without any apparent breathing, till the heat of the ſpring reſtores their wonted powers of life, when the reſpiration of air becomes again equally neceſſary as before their torpor commenced. The toad, like all the frog-kind, is torpid in winter. At the approach of winter, the toad retires to the hollow root of a tree, to the cleft of a rock, and ſometimes to the bottom of a ditch or pond, where it remains for months in a ſtate of ſeeming inſenſibility. In this laſt ſituation, it can have very little communication with the air. But ſtill the principle of life is continued, and the animal revives in the ſpring. What is more wonderful, toads have been found, in a hundred places of the globe, incloſed in the heart of ſolid rocks, and in the bodies of trees, where they have been ſuppoſed to exiſt for centuries, without any apparent acceſs either to nouriſhment or to air; and yet they were alive and vigorous. In the Memoirs of the Academy of Sciences for the year 1719, we have an account of a toad found alive, and healthy, in the heart of an old elm. Another, in the year 1731, was diſcovered, near Nantz, in the heart of an old oak, without any viſible entrance to its habitation. From the ſize of the tree, it was concluded, that the animal muſt have been confined in that ſituation at leaſt eighty or a hundred years. In the many examples of toads found in ſolid rocks, exact impreſſions of the animals bodies, correſponding to their reſpective ſizes, were uniformly left in the ſtones or trees from which they were diſlodged; and, to this day, it is ſaid, that there is a marble chimney-piece at Chatſworth with a print of a toad in it;

and a traditionary account of the place and manner in which it was diſcovered.

Theſe, and ſimilar facts, are ſupported by authorities ſo numerous and ſo reſpectable, that it is unneceſſary to quote them. Many abortive attempts have been made to account for an animal's growing and living very long in the ſituations above deſcribed, without the poſſibility of receiving nouriſhment or air; eſpecially as, like all other animals, when put into an exhauſted receiver, the toad ſoon loſes its exiſtence. Upon this ſubject I ſhall only hazard two obſervations. The toad, it is well known, when kept in a damp place, can live ſeveral months without food of any kind, though, in its ſtate of natural liberty, it devours voraciouſly ſpiders, maggots, ants, and other inſects. Here we have an inſtance, and there are many, of an animal whoſe conſtitution is ſo framed by Nature, that it can exiſt ſeveral months without receiving any portion of food. According to our ideas of the neceſſity of frequent ſupplies of nouriſhment, it is nearly as difficult for us to conceive an abſtinence of four or ſix months as one of as many years, or even centuries. The one fact, therefore, though we are unable to account for either, may be as readily admitted as the other. The ſame remark is equally applicable to the regular reſpiration of air. The toad, and many other animals, from ſome peculiarity in their conſtitution, can live very long in a torpid ſtate without ſeeming to reſpire, and yet their principle of life is not entirely extinguiſhed. Hence the toad may, and actually does, live many years in ſituations which exclude a free intercourſe with the external air. Beſides, almoſt all the above, and ſimilar facts, muſt, from their nature, have been diſcovered by common labourers, who are totally unqualified for examining every circumſtance with the diſcerning eye of a philoſopher. In rocks there are many chinks, as well as fiſſures, both horizontal and perpendicular; and in old trees nothing is more frequent than holes and vacuities of different dimenſions.

ſions. Through theſe fiſſures and vacuities the eggs of toads may accidentally be conveyed by water, the penetration of which few ſubſtances are capable of reſiſting. After the eggs are hatched, the animals may receive moiſture, and ſmall portions of air, through the crevices of rocks, or the channels of aged trees. But I mean not to perſuade; for I cannot ſatisfy myſelf. All I intend is to recommend, to thoſe gentlemen who may hereafter chance to ſee ſuch rare phaenomena, a ſtrict examination of every circumſtance that can throw light upon a ſubject ſo dark and myſterious; for the vulgar, ever inclined to render uncommon appearances ſtill more marvellous, are not to be truſted.

From the facts I have enumerated, it is apparent that air, in certain proportions, according to the ſtructure and conſtitution of every animated being of which we have any knowledge, is indiſpenſibly neceſſary for the exiſtence and continuation of animal life. Not only men, quadrupeds, birds, fiſhes, reptiles, and the larger inſects, but even fleas, mites, the minute eels found in paſte or in vinegar, and the animalcules produced by infuſing animal or vegetable ſubſtances in water, inevitably periſh when deprived of this all-vivifying element.

With regard to plants, air is ſo neceſſary to their exiſtence, that they do not vegetate in an exhauſted receiver. Plants, as formerly mentioned, are furniſhed with numerous air-veſſels, or reſpiratory organs. They abſorb and tranſmit air through every pore. When placed in an exhauſted receiver, the air contained in every part of their ſubſtance is ſoon extracted; and, in proportion as this air is likewiſe pumped out by the machine, the flowers and leaves ſhow evident ſymptoms of debility; they become flaccid, pendulous, and aſſume a ſickly appearance; and, if retained in that ſituation a certain length of time, their vegetating powers are irrecoverably extinguiſhed.

Upon the whole, as the air we continually breathe is an univerſal menſtruum, and, of courſe, liable to be impregnated with exhalations from every ſubſtance to which it has acceſs, the great importance of perſonal, as well as of domeſtic cleanlineſs, is an obvious reflection. In building towns or houſes, the ſituation, with regard to air, is a capital object. The vicinity of marſhes, of ſtagnating waters, of manufactures of tallow, oil, ſal ammoniac, the ſmelting or corroding of metals of every kind, and many other operations which contaminate the air, ſhould be either avoided or removed, as they are the peſts of our ſenſes, and the poiſoners of our conſtitutions. Even in northern climates, houſes ſurrounded with trees, or in the neighbourhood of luxuriant vegetables, are always damp, and infeſted with inſects; and hence the ambient air is replete with the ſeeds of diſeaſe. Precautions of this kind are ſtill more neceſſary in hot climates. Air, like other menſtruums, abſorbs a greater or leſs proportion of the particles of bodies, according to its degree of heat. In Madrid, however, in Conſtantinople, and in many other cities of warm regions, the houſes are crouded together, the ſtreets are narrow, and covered with filth of every kind. We cannot, therefore, be ſurpriſed, that human beings exiſting in ſuch ſituations ſhould be ſo frequently infected with peſtilential diſeaſes.

CHAPTER IV.

Of Motion.

MOTION, in the opinion of Ariſtotle, and the admirers of ancient philoſophy, can only be produced by mind; and hence they define *mind* to be the *power of moving*. By the ſame mode of reaſoning, it may be ſaid that *reſt*, or *inactivity*, is the *power of being moved*. But ſuch ſpeculations are foreign to the nature of this work, and perhaps fruitleſs in themſelves. Though it is impoſſible to give an unexceptionable definition of motion, the phaenomenon itſelf is obvious to every man's ſenſes.

All the terreſtrial objects which preſent themſelves to our obſervation are, with regard to motion, diſtinguiſhable into two general claſſes. The firſt conſiſts of thoſe which are endowed with a ſpontaneous or ſelf-moving power, and with ſome qualities and affections ſimilar to thoſe of our minds. The ſecond conſiſts of all thoſe objects in which no ſuch qualities and affections appear, and are of a nature ſo paſſive, that they never move of themſelves, nor, when put in motion, do they ever ſtop without ſome external influence or reſiſtance. The firſt claſs of objects, from their poſſeſſing the power of ſpontaneous motion, and other qualities peculiar to animated beings, are eaſily diſtinguiſhed from body, or matter, which is totally deprived of all theſe qualities. In conſequence of its paſſive nature, matter not only never changes its ſtate without external force, but reſiſts when any ſuch change is attempted to be made. When at reſt, it cannot be put in motion without difficulty; and, when in motion, a certain force is required to ſtop its courſe. The force with which matter perſeveres in its ſtate, and reſiſts any change, is called its *vis inertiae*, and is always proportional to the quantity of matter in any particular body. When we double or triple a body, we uniformly find, that the force requiſite to move it with equal celerity muſt likewiſe be doubled or tripled. Theſe, and ſimilar facts, which are reſults of perpetual experience, ſhow that body is equally indifferent to motion and reſt; that this indifference ſeems to be the natural conſequence of the moſt abſolute inactivity; and that the power of beginning motion is peculiar to active and intelligent beings. Leaving, therefore, all metaphyſical ſpeculations on this ſubject, we ſhall give ſome remarks upon the motions of animals.

In general, all the progreſſive motions of animals are performed by the inſtrumentality of muſcles, tendons, and articulations. The operation of muſcles depends upon ſome unknown influence derived to them from the brain and nerves. Hence the brain and nerves are the ſources of every motion as well as of every ſenſation. With regard to the cauſes which determine the actions of animals, theſe muſt be referred to ſenſation, and the conſequent exertions of intellect. The firſt impreſſion an object makes upon our ſenſations ſtimulates us either to approach or retire from it, according as it excites affection or averſion. Theſe motions neceſſarily reſult from the firſt impreſſion made by the object. But man, and many other animals, have the power of reſiſting theſe original motives to action, and of remaining at reſt, without either retiring or approaching. 'If

‘ a man,’ ſays the Count de Buffon, ‘ were deprived of ſight, he ‘ would make no movement to gratify his eyes. The ſame thing ‘ would happen, if he were deprived of any of the other ſenſes; ‘ and, if deprived of every ſenſe, he would remain perpetually at ‘ reſt, and no object would excite him to move, though, by natural ‘ conformation, he were fully capable of motion.’ Natural wants, as that of taking nouriſhment, neceſſarily excite deſire or appetite. But, if a man be deprived of ſenſation, want cannot exiſt, becauſe all its ſources are annihilated. This is cutting off all the cauſes, and at the ſame time looking for the effects. An animal without ſome ſenſation is no animal, but a dead maſs of matter. Sentiment is the only ſtimulus to animal motion; the aptneſs of the parts produces the effect, which varies according to the ſtructure and deſtination of theſe parts. The ſenſe of want creates deſire. Whenever an animal perceives an object fitted to ſupply its wants, deſire is the neceſſary conſequence, and action or motion inſtantly ſucceeds.

Beſide progreſſive motion, the motion of hands, and other parts of animal bodies, which are all effected by means of muſcles, and are ſubject to the will of the creatures who perform them, there are other motions that have little or no dependence on our inclinations. Of this kind are the action of the heart, the circulation of the blood, the digeſtion of food, the periſtaltic motion of the bowels, the progreſs of the chyle from the ſtomach and inteſtines to the ſubclavian vein, the movement of the various ſecreted liquors, ſuch as the gall, the urine, the ſaliva, &c. Theſe, together with the action of the lungs in reſpiration, have received the denomination of *vital* and *involuntary motions*, becauſe moſt of them go on without any conſcious exertions of the intellectual principle. If ſuch a variety of nice and complicated movements had been left to the determination and direction of our minds, they muſt neceſſarily have occupied too much of our attention; and many of them would infallibly have been neglected during ſleep, when conſciouſneſs is often almoſt totally ſuſpended. But Nature in her operations is always wiſe. She has given to man, and other animals, the direction of no movements but what are eaſily performed, contribute to pleaſure and health, and enable them to acquire food correſponding to the ſtructure of their bodies and the elements in which they live.

It never was my intention, and, indeed, it would have been foreign to the deſign of this work, and ill ſuited to that claſs of mankind to whom I wiſh chiefly to be uſeful, to enter into the *rationale* of animal motion; to mention the number, inſertion, and direction, of the muſcles employed in moving the different parts of animated bodies; or to account for the modes by which animals walk, leap, fly, ſwim, creep, &c. Such diſcuſſions would not only require a volume, but a thorough acquaintance with all the depths of anatomical and mathematical knowledge. What follows, therefore, will conſiſt of ſome deſultory obſervations; and the ſubject ſhall be concluded by enumerating a few examples of movements peculiar to certain animals.

The motions of animals are proportioned to their weight and ſtructure. A flea can leap ſome hundred times its own length. Were an elephant, a camel, or a horſe, to leap in the ſame proportion, their weight would cruſh them to atoms. The ſame remark is applicable to ſpiders, worms, and other inſects. The ſoftneſs of their texture, and the comparative ſmallneſs of their ſpecific gravity, enable them to fall with impunity from heights that would prove fatal to larger and heavier animals.

Motion gives birth, perfection, death, and reproduction, to all animal and vegetable beings. It is the cauſe of all that diverſity and change which perpetually affect every object in the univerſe.

The globe we inhabit, as well as the innumerable and ſtupendous heavenly bodies which preſent themſelves, in forms apparently minute to our obſervation, conſtantly exhibit motions of the moſt inconceivable rapidity. The magnitude of this earth, when conſidered with relation to man, and other animals, appears to be exceedingly great. It is indeed ſufficiently ſpacious, and ſufficiently prolific, for the conveniency and maintenance of its inhabitants. The magnificent objects diſplayed on its ſurface excite the admiration of every beholder. Its plains and mountains, its rivers and lakes, its iſlands and continents, its ſeas and oceans, continually ſollicit attention, gratify curioſity, and call forth the powers of reaſon and reflection. But, when compared to the other heavenly bodies, the number and magnitude of which exceed all the powers of human conception, the grandeur of our earth diminiſhes. Inſtead of exciting wonder, it almoſt vaniſhes from our ſight. Inſtead of an immenſe globe, it dwindles into a point, ſeems to occupy no ſpace, and loſes itſelf in the boundleſs regions of the univerſe. Conſiderations of this kind are apt to depreſs the dignity of man, and to leſſen his importance in the great ſcale of being; but they expand his mental faculties, and exalt his ideas concerning that inconceivable Power which firſt produced, and ſtill ſupports, thoſe aſtoniſhing orbs.

The different movements to which animals are ſtimulated by the deſire of food, by love, by the appetite for frolic and exerciſe, by their hoſtilities, and by other exciting cauſes, give animation and vivacity to the whole ſcene of nature. A ſilent and motionleſs proſpect, however beautiful and variegated, ſoon ceaſes to pleaſe, and at laſt becomes inſupportable. Motion, ſays Mr Harris, is the object or cauſe of all ſenſation. In muſic we hear it; in ſavours we taſte it; in odors we ſmell it; in touch we feel it; in light we ſee it.

Animals furniſhed with deſtructive weapons, or endowed with uncommon ſtrength, courage, or ingenuity, are proportionally ſlower in their movements than the weaker kinds. The ſame remark is applicable to thoſe ſpecies whoſe food is always at hand. Worms, caterpillars, and many other inſects, in order to procure nouriſhment, are under no neceſſity of taking an extenſive range. But the motions of birds and fiſhes are extremely rapid; becauſe, in queſt of food, they are obliged to paſs through large tracks, and they have alſo many enemies to avoid.

Timid animals, as the hare, the rabbit, the Guiney-pig, &c. are almoſt perpetually in motion. Even when perfectly undiſturbed, they are reſtleſs, and betray a continual anxiety of danger. They run about, ſtop ſhort, erect their ears, and liſten. The Guiney-pig frequently raiſes itſelf on its hind-legs, and ſnuffs all around to catch the ſcent of food when hungry, or to increaſe its circle of hearing when afraid.

The movements of many animals are ſo extremely ſlow, that ſome of them, particularly thoſe of the ſhell tribes, are generally ſuppoſed to be deſtitute of the power of moving. It is a common notion, that both freſh and ſalt water muſcles have not the locomotive faculty. But this is a vulgar error. It is almoſt unneceſſary to mention, that the exterior part of muſcles conſiſts of two ſhells hinged together, which the animals can open or ſhut at pleaſure. Every perſon muſt likewiſe have obſerved, in the ſtructure of the animal itſelf, a fleſhy protuberance of a much redder colour, and denſer conſiſtence, than the other parts of the body. This muſcular protuberance, which conſiſts of two lobes, has been denominated a *trunk*, or *tongue:* But it is an inſtrument by which the creature is enabled to perform a progreſſive, though a very ſlow motion; and, therefore, in deſcribing its manner of moving, I ſhall call theſe two lobes the animal's *tentacula*, or *feet*.

When inclined to remove from its preſent ſituation, the river-muſcle opens its ſhell, thruſts out its tentacula, and, while lying on its ſide in an horizontal poſition, digs a ſmall furrow in the ſand. Into this furrow, by the operation of the ſame tentacula, the animal makes the ſhell fall, and thus brings it into a vertical poſition. We have now got our muſcle on end; but how is he to proceed? He ſtretches forward his tentacula, by which he throws back the ſand, lengthens the furrow, and this fulcrum enables him to proceed on his journey.

With regard to marine muſcles, their progreſſive motion is performed in the ſame manner, and by the ſame inſtruments. When not in motion, they are all firmly attached to rocks, or ſmall ſtones, by many threads of about two inches in length, which ſerve the double purpoſes of an anchor and cable. Without this proviſion of Nature, theſe animals muſt become the ſport of the waves, and the ſpecies would ſoon be annihilated. But, how does the creature ſpin theſe threads? A cylindrical canal extends from the origin to the extremity of the tentacula. In this canal an extremely glutinous ſubſtance is ſecreted, which the animal, by the operation of certain muſcles, has the power of forcing out, and of attaching it, in the form of ſtrong threads, to ſtones or other ſolid bodies. More than a hundred and fifty of theſe cables are often employed in mooring a ſingle muſcle *. The ſubſtance of the threads is exceedingly viſcous, indigeſtible in the human ſtomach, and is probably the cauſe of thoſe fatal conſequences which ſometimes happen to inattentive eaters. In Scotland, theſe threads are called the *beards* of

muſcles,

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* Oeuvres de Bonnet, tom. 5. pag. 361. 4to edit.

muſcles, and ſhould be carefully pulled off before the animals are thrown into the ſtomach.

Other bivalved ſhell-fiſhes, the ſpecies of which are numerous, perform a progreſſive or retrograde motion by an inſtrument that has no ſmall reſemblance to a leg and foot. But the animals can, at pleaſure, make this leg aſſume almoſt every kind of form, according as their exigencies may require. By this leg they are not only enabled to creep, to ſink into the mud, or diſengage themſelves from it, but to perform a motion, which no man could ſuppoſe ſhell-fiſhes were capable of performing. When the tellina, or limpin, is about to make a ſpring, it puts the ſhell on the point or ſummit, as if with a view to diminiſh friction. It then ſtretches out the leg as far as poſſible, makes it embrace a portion of the ſhell, and, by a ſudden movement, ſimilar to that of a ſpring let looſe, it ſtrikes the earth with its leg, and actually leaps to a conſiderable diſtance *.

The ſpout-fiſh † has a bivalved ſhell, which reſembles the handle of a razor. This animal is incapable of progreſſive motion on the ſurface; but it digs a hole or cell in the ſand, ſometimes two feet in depth, in which it can aſcend and deſcend at pleaſure. The inſtrument or leg by which it performs all its movements is ſituated at the centre. This leg is fleſhy, cylindrical, and pretty long. When neceſſary, the animal can make the termination of the leg aſſume the form of a ball. The ſpout-fiſh, when lying on the ſurface of the ſand, and about to ſink into it, extends its leg from the inferior end of the ſhell, and makes the extremity of it take on the form of a ſhovel, ſharp on each ſide, and terminating in a point. With this inſtrument the animal cuts a hole in the ſand. After the hole is made, it advances the leg ſtill farther into the ſand, makes it aſſume the

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* Oeuvres de Bonnet, tom. 5. pag. 341. 4to edit.

† The name of the animal in Scotland. In England it is called *razor-fiſh*.

the form of a hook, and with this hook, as a fulcrum, it obliges the ſhell to deſcend into the hole. In this manner the animal operates till the ſhell totally diſappears. When it chooſes to regain the ſurface, it puts the termination of the leg into the ſhape of a ball, and makes an effort to extend the whole leg; but the ball prevents any farther deſcent, and the muſcular effort neceſſarily puſhes the ſhell upward till it reaches the ſurface, or top of the hole. It is amazing with what dexterity and quickneſs theſe ſeemingly awkward motions are performed.

It is remarkable that the ſpout-fiſh, though it lives in ſalt water, abhors ſalt. When a little ſalt is thrown into the hole, the animal inſtantly quits his habitation. But it is ſtill more remarkable, that, if you ſeize the animal with your hand, and afterwards allow it to retire into its cell, you may ſtrew as much ſalt upon it as you pleaſe, but the fiſh will never again make its appearance. If you do not handle the animal, by applying ſalt, you may make it come to the ſurface as often as you incline; and fiſhermen often make uſe of this ſtratagem. This behaviour indicates more ſentiment and recollection than one ſhould naturally expect from a ſpout-fiſh.

The ſcallop, another well known bivalved ſhell-fiſh, has the power of progreſſive motion upon land, and likewiſe of ſwimming on the ſurface of the water. When this animal happens to be deſerted by the tide, it opens its ſhell to the full extent, then ſhuts it with a ſudden jerk, by which it often riſes five or ſix inches from the ground. In this manner it tumbles forward till it regains the water. When the ſea is calm, troops, or little fleets of ſcallops, are often obſerved ſwimming on the ſurface. They raiſe one valve of their ſhell above the ſurface, which becomes a kind of ſail, while the other remains under the water, and anſwers the purpoſe of an anchor, by ſteadying the animal, and preventing its being overſet. When an enemy approaches, they inſtantly ſhut their ſhells, plunge to the bottom, and the whole fleet diſappears. By what means they are enabled to regain the ſurface, we are ſtill ignorant.

With regard to the locomotive faculty of the oyſter, the following facts are recorded in the *Journal de Phyſique* by the Abbé Dicquemare. Like many other bivalved ſhell-fiſh, the oyſter has the power of ſquirting out water with a conſiderable force. By thus ſuddenly and forcibly ejecting a quantity of water, the animal repulſes ſuch enemies as endeavour to inſinuate into its ſhell while open. By the ſame operation, if not firmly attached to rocks, to ſtones, or to one another, the oyſter retreats backwards, or ſtarts to a ſide in a lateral direction. Any perſon may amuſe himſelf with the ſquirting and motions of oyſters, by putting them in a plate ſituated in a horizontal poſition, and which contains as much ſea-water as is ſufficient to cover them. The oyſter has been repreſented by many authors as an animal deſtitute not only of motion, but of every ſpecies of ſenſation. The Abbé Dicquemare, however, has ſhown, that it can perform movements perfectly conſonant to its wants, to the dangers it apprehends, and to the enemies by which it is attacked. Inſtead of being deſtitute of all ſenſation, oyſters are capable of deriving knowledge from experience. When removed from ſituations which are conſtantly covered with the ſea, devoid of experience, they open their ſhells, loſe their water, and die in a few days. But, even when taken from ſimilar ſituations, and laid down in places from which the ſea occaſionally retires, they feel the effects of the ſun's rays, or of the cold air, or perhaps apprehend the attacks of enemies, and accordingly learn to keep their ſhells cloſe till the tide returns. Conduct of this kind plainly indicates both ſenſation and a degree of intelligence.

The progreſſive motion of [illegible] ſea-urching, or ſea-egg, a well known multivalved ſhell-fiſh, merits our attention. This animal, of which there are ſeveral ſpecies, is round, oval, or ſhaped like a bias-bowl. The ſurface of the ſhell is divided into beautiful triangular compartments, and covered with numberleſs prickles; from which laſt circumſtance it has received the appellation of *ſea-urchin*, or *ſea-hedge-hog*. Theſe triangles are ſeparated by regular belts, and perforated by a great number of holes. Each hole gives lodgement to a fleſhy horn ſimilar to thoſe of the ſnail, and ſuſceptible of the ſame movements. Like the ſnail, the ſea-urchin uſes its horns when in motion; but their principal uſe is to fix the animal to rocks, ſtones, or the bottom of the ocean. By means of the horns and prickles, which proceed from almoſt every point of the ſhell, the ſea-urchin is enabled to walk either on its back or on its belly. The limbs it moſt generally employs are thoſe which ſurround the mouth. But, when it chooſes, it can move forward, by turning on itſelf like the wheel of a coach. Thus the ſea-urchin furniſhes an example of an animal employing many thouſand limbs in its various movements. The reader may try to conceive the number of muſcles, of fibres, and of other apparatus, which are requiſite to the progreſſive motion of this little animal.

The motion of that ſpecies of meduſa, or ſea-nettle, which attaches itſelf to rocks, and to the larger ſhell-fiſh, is extremely ſlow. The ſea-nettles aſſume ſuch a variety of figures, that it is impoſſible to deſcribe them under any determinate ſhape. In general, their bodies have a reſemblance to a truncated cone. The baſe of the cone is applied to the rock, or other ſubſtance to which they adhere. With regard to colour, ſome of them are red, ſome greeniſh, ſome whitiſh, and others are brown. When the mouth, which is very large, is expanded, its margin is ſurrounded with a great number of fleſhy filaments, or horns, ſimilar to thoſe of the ſnail. Theſe horns are diſpoſed in three rows around the mouth, and give the animal the appearance of a flower. Through each of theſe horns the ſea-nettle ſquirts water, like ſo many jets-d'eau. What is peculiar in the ſtructure of theſe creatures, the whole interior part of their body, or cone, is one cavity or ſtomach. When ſearching for food, they extend their filaments, and entangle any ſmall animals they encounter. When they meet with their prey, they inſtantly ſwallow it, and ſhut their mouths cloſe like a purſe. Though the animal ſhould not exceed an inch, or an inch and a half, in diameter, as it is all mouth and ſtomach, it ſwallows large whelks and muſcles. Theſe ſhell-animals ſometimes remain many days in the ſtomach before they are ejected. Their nutrifying parts are at laſt, however, extracted; but how does the ſea-nettle get quit of the ſhell? The creature has no other aperture in its body but the mouth, and this mouth is the inſtrument by which it both receives nouriſhment, and diſcharges the excrement, or unprofitable part of its food. When the ſhell is not too large, the ſea-nettle has the power of turning its inſide out, and by this ſtrange maneouvre the ſhell is thrown out of the body, and the animal reſumes its former ſtate. But, when the ſhell preſents itſelf in a wrong poſition, the animal cannot diſcharge it in the uſual manner; but, what is extremely ſingular, near the baſe of the cone, the body of the creature ſplits, as if a large wound had been made with a knife, and through this gaſh the ſhell of the muſcle, or other ſhell, is ejected.

With regard to the progreſſive motion of the ſea-nettle, it is as ſlow as the hour-hand of a clock. The whole external part of its body is furniſhed with numerous muſcles. Theſe muſcles are tubular, and filled with a fluid, which makes them project in the form of prickles. By the inſtrumentality of theſe muſcles, the animal is enabled to perform the very ſlow motion juſt now mentioned. But this is not the only means by which the ſea-nettle is capable of moving.

ving. When it pleaſes, it can looſen the baſe of the cone by which it is attached to the rock, reverſe its body, and employ the filaments round its mouth as ſo many limbs. Still, however, its movements are imperceptibly ſlow. For theſe facts ſeveral authors might be quoted; but we ſhall refer the reader ſolely to M. de Bonnet *.

Before we conclude this chapter, we ſhall juſt mention a mode of flying which is peculiar to certain inſects. The *maſon-bee*, which is one of the ſolitary ſpecies, has received that appellation, becauſe it conſtructs a neſt with mud or mortar. Externally, this neſt has no regular appearance; and is, therefore, generally regarded as a piece of dirt accidentally adhering to a wall. This habitation, however unſeemly in its exterior aſpect, is furniſhed with regular cells, and often gives riſe to great conflicts. When the real proprietor is abroad in queſt of materials to finiſh the neſt, a ſtranger takes poſſeſſion. At meeting, a battle always enſues. This battle is fought in the air. Sometimes they fly with ſuch rapidity and force againſt each other, that both parties fall to the ground. But, in general, like birds of prey, the one endeavours to riſe above the other, and to give a downward blow. To avoid the ſtroke, the undermoſt, inſtead of flying forward or laterally, is frequently obſerved to fly backward. This retrograde flight is likewiſe performed occaſionally by the common houſe-fly, and ſome other inſects, though we are unable to perceive what ſtimulates them to employ this uncommon movement.

CHAP.

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* Oeuvres de Bonnet, 4to edit. tom. 5. pag. 345.

CHAPTER V.

Of the Inſtinct of Animals—Diviſion of Inſtincts—Examples of Pure Inſtinct—Of ſuch Inſtincts as can accommodate themſelves to peculiar circumſtances and ſituations—Of Inſtincts improveable by obſervation and experience—Some remarks and concluſions from this view of Inſtinct.

MANY theories have been invented with a view to explain the inſtinctive actions of animals; but none of them have received the general approbation of Philoſophers. This want of ſucceſs in the inveſtigation of a ſubject ſo curious and ſo intereſting muſt be owing to the operation of ſome powerful cauſes. Two of theſe cauſes appear to be a want of attention to the general oeconomy and manners of animals, and miſtaken notions concerning the dignity of human nature. From peruſing the compoſitions of moſt authors who have written upon animal inſtinct, it is evident, that they have chiefly derived their ideas, not from the various mental qualities diſcoverable in different ſpecies of animals, but from the feelings and propenſities of their own minds. Some of them, at the ſame time, are ſo averſe to allow brutes a participation of that intellect which man poſſeſſes in ſuch an eminent degree, that they conſider every animal action to be the reſult of pure mechaniſm.

chaniſm. But the great ſource of error on this ſubject is the uniform attempt to diſtinguiſh inſtinctive from rational motives. I ſhall, however, endeavour to ſhow that no ſuch diſtinction exiſts, and that the reaſoning faculty itſelf is a neceſſary reſult of inſtinct.

The proper method of inveſtigating ſubjects of this kind, is to collect and arrange the facts which have been diſcovered, and to conſider whether theſe facts lead to any general concluſions. This method I have adopted; and ſhall therefore exhibit examples of pure inſtincts; of ſuch inſtincts as can accommodate themſelves to peculiar circumſtances and ſituations; and of inſtincts improveable by obſervation and experience. In the laſt place, I ſhall draw ſome concluſions.

I. *Of Pure Inſtincts.*

By *pure* inſtincts, I mean thoſe, which, independent of all inſtruction or experience, inſtantaneouſly produce certain actions when particular objects are preſented to animals, or when they are influenced by peculiar feelings. Of this claſs the following are examples.

In the human ſpecies, the inſtinct of ſucking is exerted immediately after birth. This inſtinct is not excited by any ſmell peculiar to the mother, to milk, or to any other ſubſtance; for infants ſuck indiſcriminately every thing brought into contact with their mouths. The deſire of ſucking, therefore, is innate, and coeval with the appetite for air.

The voiding of urine and excrement, ſneezing, retraction of the muſcles upon the application of any painful ſtimulus, the moving of the eye-lids, and other parts of the body, are likewiſe effects of original inſtincts, and eſſential to the exiſtence of young animals.

The love of light is exhibited by infants at a very early period. I have remarked evident ſymptoms of this attachment on the third day after birth. When children are farther advanced, marks of the various paſſions gradually appear. The paſſion of fear is diſcoverable at the age of two months. It is called forth by approaching the hand to the child's eye, and by any ſudden motion or unuſual noiſe. I once inſtituted a courſe of experiments to aſcertain the periods when the various paſſions, principles, or propenſities, of the human mind are unfolded, and to mark the cauſes which firſt produced them. But, in leſs than five months after the birth of the child, the buſineſs became too complicated and extenſive for the time I had to beſtow on ſubjects of this nature.

The brute creation affords innumerable examples of pure inſtincts.

When caterpillars are ſhaken off a tree in every direction, all of them inſtantly turn toward the trunk, and climb up, though they had never formerly been on the ſurface of the ground.

Young birds open their mouths upon hearing any kind of noiſe, as well as that of their mother's voice. They have no apprehenſions of harm; neither do they offer to uſe their wings till they acquire more ſtrength and experience. The lion's cub is not ferocious till he feels force and activity for deſtruction.

Inſects invariably depoſit their eggs in ſituations moſt favourable for hatching and affording nouriſhment to their future progeny. Butterflies, and other inſects, whoſe offspring feed upon vegetables, uniformly fix their eggs upon ſuch plants as are moſt agreeable to the palate and conſtitution of their young. Water inſects never depoſit their eggs on dry ground. I have ſeen butterflies which had been transformed in the houſe exhibit marks of the greateſt uneaſineſs becauſe they could not find a proper nidus for their eggs; and, when every other reſource failed, they paſted the eggs on the panes of the window.

Some ſpecies of animals look not to future wants. Others, as the bee and the beaver, are endowed with an inſtinct which has the appearance of foreſight. They conſtruct magazines, and fill them with proviſions.

The common bees attend the female, or queen, do her many little ſervices, and even feed her with honey from their trunks *. When deprived of the female, all their labours ceaſe †, till a new one is obtained, whom they treat with much reſpect, and renew their uſual operations ‡. They make cells of three different dimenſions, for holding workers, drones, and females; and the queen-bee, in depoſiting her eggs, diſtinguiſhes the three different kinds, and never puts a royal or a drone egg into the cells deſtined for the reception of the working bees. What is equally ſingular, the number of theſe cells is proportioned to that of the different bees to be produced. One royal cell weighs as much as one hundred of the common kind ‖. When there are ſeveral females in a hive, the bees work little till they have deſtroyed all the females but one. If more than a ſingle female were allowed to remain in a hive, a greater number of eggs would be laid than the working bees are able to make cells for receiving them.

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* Reaumur, 12mo edit. vol. 9. pag. 300.

† Ibid. pag. 320.

‡ Ibid. pag. 340.

‖ Ibid. tom. 10. pag. 124.

The wood-piercing bee, which is one of the ſolitary ſpecies, gnaws, with amazing dexterity and perſeverance, a large hole in old timber. After laying her eggs in the cells, ſhe depoſits ſuch a quantity of glutinous matter as nouriſhes the worms produced from theſe eggs till the time of their transformation into flies. She then paſtes up the mouth of the hole, and leaves her future offspring to the proviſion ſhe has made for them.

The bees of that ſpecies which build cylindrical neſts with roſe-leaves, exhibit a very peculiar inſtinct. They firſt dig a cylindrical hole in the earth. When that operation is finiſhed, they go in queſt of roſe-buſhes; and, after ſelecting leaves proper for their purpoſe, they cut oblong, curved, and even round pieces, exactly ſuited to form the different parts of the cylinder *.

The ſolitary waſp digs holes in the ſand. In each hole ſhe depoſits an egg. But how is the worm, after it is hatched, to be nouriſhed? Here the inſtinct of the mother merits attention. Though ſhe feeds not upon fleſh herſelf, and certainly knows not that an animal is to proceed from the egg, and far leſs that this animal muſt be nouriſhed with other animals, ſhe collects ten or twelve ſmall green worms, which ſhe piles one above another, rolls them up in a circular form, and fixes them in the hole in ſuch a manner that they cannot move. When the waſp-worm is hatched, it is amply ſtored with the food Nature has deſtined for its ſupport. The green worms are devoured in ſucceſſion †; and the number depoſited is exactly proportioned to the time neceſſary for the growth and transformation of the waſp-worm into a fly, when it iſſues from the hole, and is capable of procuring its own nouriſhment ‡.

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* Reaumur, tom. 11. pag. 138.

† Ibid. tom. 12. pag. 18.

‡ Ibid. pag. 22.—32.

There are many other inſtances of ichneumon waſps and flies, which, though they feed not themſelves upon worms, lay up proviſions of theſe animals for the nouriſhment of their young; and each kind is adapted to the conſtitution of the worm that is to proceed from their eggs *.

Birds of the ſame ſpecies, unleſs when reſtrained by peculiar circumſtances, uniformly build their neſts of the ſame materials, and in the ſame form and ſituation, though they inhabit very different climates. When removed by neceſſity from their eggs, they haſten back to them with anxiety. They turn and ſhift their eggs, which has the effect of heating them equally. Ducks and geeſe cover up their eggs till they return to the neſt. A hen ſits with equal ardour upon eggs of a different ſpecies, or even upon artificial eggs. I have often contemplated with wonder an inſtinct of the ſwallow. When her offspring are very young, like other ſmall birds, ſhe carries their excrements out of the neſt. But, after they are older, ſhe attaches herſelf to the ſide of the neſt, and, by ſome geſtures and ſounds, ſollicits the young to void their excrements: One of them immediately turns round, elevates its hind parts above the edge of the neſt, makes the proper effort, and the mother, before the dung is half protruded from the anus, lays hold of it with her bill, drags it out, carries it off, and drops it at a diſtance from the neſt. In all theſe operations, men recogniſe the intentions of Nature; but they are hid from the animals who perform them.

The ſpider, the dermeſtes, and many inſects of the beetle kind, exhibit an inſtinct of a very uncommon nature. When put in terror by a touch of the finger, the ſpider runs off with great ſwiftneſs: But, if he finds, that, whatever direction he takes, he is oppoſed by another

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* Reaumur, tom. II. pag. 38.

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* Reaumur, tom. 11. pag. 38.

another finger, he then ſeems to deſpair of being able to eſcape, contracts his limbs and body, lies perfectly motionleſs, and counterfeits every ſymptom of death. In this ſituation I have pierced ſpiders with pins, and torn them to pieces, without their diſcovering the ſmalleſt mark of pain. This ſimulation of death has been aſcribed to a ſtrong convulſion, or ſtupor, occaſioned by terror. But this ſolution of the phaenomenon is erroneous. I have repeatedly tried the experiment, and uniformly found, that, if the object of terror be removed, in a few ſeconds the animal runs off with great rapidity. Some beetles, when counterfeiting death, ſuffer themſelves to be gradually roaſted, without moving a ſingle joint.

It is unneceſſary to give more examples of pure inſtincts. I ſhall therefore proceed to the ſecond claſs, namely,

II. *Of Inſtincts which can accommodate themſelves to peculiar circumſtances and ſituations.*

To this claſs many human inſtincts may be referred. But, as theſe inſtinctive propenſities are likewiſe highly improveable by experience and obſervation, examples of them will fall more naturally to be given under the third claſs.

Thoſe animals are moſt perfect whoſe ſphere of knowledge extends to the greateſt number of objects. When interrupted in their operations, they know how to reſume their labours, and to accompliſh their purpoſes by different means. Some animals have no other power but that of contracting or extending their bodies. But the falcon, the dog, and the fox, purſue their prey with intelligence and addreſs.

The oſtrich has been accuſed of unnaturalneſs, becauſe ſhe leaves her eggs to be hatched by the heat of the ſun. In Senegal, where the heat is great, ſhe neglects her eggs during the day, but ſits upon them in the night. At the Cape of Good Hope, however, where the degree of heat is leſs, the oſtrich, like other birds, ſits upon her eggs both day and night.

Rabbits dig holes in the ground for warmth and protection. But, after continuing long in a domeſtic ſtate, that reſource being unneceſſary, they ſeldom employ this art *.

Bees, when they have not room enough for their operations, augment the depth of their honey-cells †. The female bee, when the cells are not ſufficiently numerous to receive her eggs, lays two or three in each cell. But, a few days after, when the cells are increaſed, the working bees remove all the ſupernumerary eggs, and depoſit them in the new conſtructed cells ‡.

When a waſp, in attempting to tranſport a dead companion from the neſt, finds the load too heavy, he cuts off its head, and carries it out in two portions ‖.

In countries infeſted with monkeys, many birds, which, in other climates, build in buſhes and the clefts of trees, ſuſpend their neſts upon ſlender twigs, and, by this ingenious device, elude the rapacity of their enemies.

The nymphs of water-moths, commonly called *cod-bait*, cover themſelves, by means of gluten, with pieces of wood, ſtraw, ſmall ſhells, or gravel. It is neceſſary that they ſhould always be nearly in equilibrium with the water in which they live. To accompliſh this purpoſe, when their habitations are too heavy, they add a piece of wood, when too light a bit of gravel *.

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* Gazette Liter. tom. 3. pag. 228.

† Reaumur, tom. 10. pag. 29.

‡ Ibid. pag. 240.

‖ Ibid. tom. 11. pag. 241.

I had a cat that frequented a cloſet, the door of which was faſtened by a common iron latch. A window was ſituated near the door. When the door was ſhut, the cat gave herſelf no uneaſineſs. As ſoon as ſhe tired of her confinement, ſhe mounted on the ſole of the window, and with her paw dexterouſly lifted the latch and came out. This practice ſhe continued for years.

Theſe examples, I hope, are ſufficient.

III. *The third claſs comprehends all thoſe Inſtincts which are improveable by experience and obſervation.*

The ſuperiority of man over the other animals ſeems to depend chiefly on the great number of inſtincts with which his mind is endowed. Traces of every inſtinct he poſſeſſes are diſcoverable in the brute creation. But no particular ſpecies enjoys the whole. On the contrary, moſt animals are limited to a ſmall number. This appears to be the reaſon why the inſtincts of brutes are ſtronger, and more ſteady in their operation, than thoſe of man. A being actuated by a great variety of motives muſt neceſſarily reaſon, or, in other words, heſitate in his choice. Its conduct, therefore, muſt often waver; and he will have the appearance of being inferior to another creature who is ſtimulated to action by a ſmaller number of motives. Man, accordingly, has been conſidered as the moſt vacillant and inconſiſtent of all animals. The remark is juſt; but, inſtead of a cenſure, it is an encomium on the ſpecies. The actions of a dog, or a monkey, for the ſame reaſon, are more various, whimſical, and uncertain, than thoſe of a ſheep or a cow.

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* Bonnet, tom. 4. pag. 209.——Reaumur, tom. 5. pag. 215.

Moſt human inſtincts receive improvement from experience and obſervation, and are capable of a thouſand modifications. This is another ſource of man's ſuperiority over the brutes. When we are ſtimulated by a particular inſtinct, inſtead of inſtantly obeying the impulſe, another inſtinct ariſes in oppoſition, creates heſitation, and often totally extinguiſhes the original motive to action. The inſtinct of fear is daily counteracted by ambition or reſentment; and, in ſome minds, fear is too powerful for reſentment, or any other inſtinct we poſſeſs. The inſtinct of anger is often reſtrained by the apprehenſion of danger, by the ſenſe of propriety, by contempt, and even by compaſſion. Sympathy, which is one of our moſt amiable inſtincts, frequently yields to anger, ambition, and other motives. The inſtinct or ſenſe of morality is too often thwarted by ambition, reſentment, love, fear, and ſeveral of what I call modified or compounded inſtincts, ſuch as avarice, envy, &c.

The following are examples of modified, compounded, or extended inſtincts.

Superſtition is the inſtinct of fear extended to imaginary objects of terror.

Devotion is an extenſion of the inſtinct of love to the Firſt Cauſe, or Author of the Univerſe.

Reverence or reſpect for eminent characters is a ſpecies of devotion.

Avarice is the inſtinct of love directed to an improper object.

Hope is the inſtinct of love directed to future good.

Envy is compounded of love, avarice, ambition, and fear.

Benevolence is the inſtinct of love diffuſed over all animated beings.

Sympathy is the inſtinct of fear transferred to another perſon, and reflected back upon ourſelves.

In this manner, all the modified, compounded, or extended paſſions and propenſities of the human mind, may be traced back to their original inſtincts.

The inſtincts of brutes are likewiſe improved by obſervation and experience. A young dog, like a child, requires both time and art to unfold and perfect his natural inſtincts. If neglected by man, he learns from his companions how to act in particular ſituations: But, when he enjoys both theſe ſources of information, his talents are improved to a degree that often excites our aſtoniſhment. The ſame remark applies to all docile animals, as the elephant, the horſe, the camel, &c. Every man's recollection will ſupply him with many examples of the improveable talents of brutes; and, therefore, it is unneceſſary to be more explicit.

Having exhibited inſtances of pure inſtinct, of inſtincts which accommodate themſelves to peculiar circumſtances and ſituations, and of inſtincts improveable by obſervation and experience, I ſhall now hazard a few remarks.

From the examples I have given, it appears that inſtinct is an original quality of mind, which, in many animals, may be improved, modified, and extended, by experience; that ſome inſtincts are coeval with birth; and that others, as fear, anger, the principle of imitation, and the power of reaſoning, or balancing motives, are gradually unfolded, according to the exigencies of the animal. One of the ſtrongeſt inſtincts appears not till near the age of puberty; but, by bad example, and improper ſituations, this inſtinctive deſire is often prematurely excited. The minds of brutes, as well as thoſe of men, have original qualities, deſtined for the preſervation of the individual and the continuation of the ſpecies. The calling forth of theſe qualities is not inſtinct, but the exertion or energy of inſtinct. Inſtincts exiſt before they act. What man or brutes learn by experince, though this experience be founded on inſtinct, cannot with propriety be called inſtinctive knowledge, but knowledge derived from experience and obſervation. Inſtinct ſhould be limited to ſuch actions as every individual of a ſpecies exerts without the aid either of experience or imitation. Hence inſtinct may be defined, ‘ Every original quality of mind which produces particular ‘ feelings or actions, when the proper objects are preſented to it.’ Theſe qualities or inſtincts vary in particular ſpecies. Some are endowed with many, and others with few. In ſome they are ſtronger, in others weaker; and their ſtrength or weakneſs ſeems to be exactly proportioned to their number. The difference of talents among men who have had the ſame culture, ariſes from a bluntneſs, or abſolute deprivation, of ſome original or modified inſtincts. Taſte, or love of particular objects, whether animated, inanimated, or artificial, is in ſome men ſo obtuſe, that we often ſay it is entirely wanting. Inſects have fewer inſtincts than men or quadrupeds; but the exertions of inſects are ſo uniform and ſteady, that they excite the admiration of every beholder.

Senſation implies a ſentient principle or mind. Whatever feels, therefore, is mind. Of courſe, the loweſt ſpecies of animals are endowed with mind: But the minds of animals have very different powers; and theſe powers are expreſſed by peculiar actions. The ſtructure of their bodies is uniformly adapted to the powers of their minds. We never ſee a mature animal attempting actions which Nature has not enabled it to perform, by beſtowing on it proper inſtruments. A bee collects the materials of honey and wax, but attempts not to gnaw rotten wood, like the waſp.—Neither does peculiarity of ſtructure prompt the actions of brutes. Calves puſh with their heads long before their horns are grown. This, and ſimilar examples, ſhew, that the inſtincts of brutes exiſt previous to the expanſion of thoſe inſtruments which Nature intended they ſhould employ.

This view of inſtinct is ſimple, removes every objection to the exiſtence of mind in brutes, and unfolds all their actions, by referring them to motives perfectly ſimilar to thoſe by which man is actuated. There is, perhaps, a greater difference between the mental powers of ſome animals than between thoſe of man and the moſt ſagacious brutes. Inſtincts may be conſidered as ſo many internal ſenſes, of which ſome animals have a greater, and others a ſmaller number. Theſe ſenſes, in different ſpecies, are likewiſe more or leſs ductile; and the animals poſſeſſing them are, of courſe, more or leſs ſuſceptible of improving, and of acquiring knowledge.

The notion that animals are machines, is perhaps too abſurd to merit refutation. Though no animal is endowed with mental powers equal to thoſe of man, yet there is not a faculty of the human mind, but evident marks of its exiſtence are to be found in particular animals. Senſes, memory, imagination, the principle of imitation, curioſity, cunning, ingenuity, devotion, or reſpect for ſuperiors,

ors, gratitude, are all diſcoverable in the brute creation. Neither is art denied to them. They build in various ſtyles; they dig; they wage war; they extract peculiar ſubſtances from water, from plants, from the earth; they modulate their voices ſo as to communicate their wants, their ſentiments, their pleaſures and pains, their apprehenſions of danger, and their proſpects of future good. Every ſpecies has its own language, which is perfectly underſtood by the individuals. They aſk and give aſſiſtance to each other. They ſpeak of their neceſſities; and this branch of their language is more or leſs extended, in proportion to the number of their wants. Geſtures and inarticulate ſounds are the ſigns of their thoughts. It is neceſſary that the ſame ſentiments ſhould produce the ſame ſounds and the ſame movements; and, conſequently, each individual of a ſpecies muſt have the ſame organization. Birds and quadrupeds, accordingly, are incapable of holding diſcourſe to each other, or communicating the ideas and feelings they poſſeſs in common. The language of geſture prepares for that of articulation; and ſome animals are capable of acquiring a knowledge of articulate ſounds. They firſt judge of our thoughts by our geſtures; and afterwards acquire the habit of connecting theſe thoughts with the language in which we expreſs them. It is in this manner that the elephant and the dog learn to obey the commands of their maſters.

Infants are exactly in the ſame condition with brutes. They underſtand ſome of our geſtures and words long before they can articulate. They diſcover their wants by geſtures and inarticulate ſounds, the meaning of which the nurſe learns by experience. Different infants have different modes of expreſſing their wants. This is the reaſon why nurſes know the intentions of infants, though they are perfectly unintelligible to ſtrangers. When an infant, accordingly, is transferred from one nurſe to another, the former inſtructs the latter in the geſtures and inarticulate language of the child.

The idea of a *machine* implies a ſelect combination of the common properties of matter. The regularity of its movements is a proof that they are totally diſtinct from animal or ſpontaneous motion. A machine has nothing analogous to ſenſation, which is the loweſt characteriſtic of an animal. An *animated machine*, therefore, is an abſurd abuſe of terms. It confounds what Nature has diſtinguiſhed in the moſt unambiguous manner. The inſtincts of brutes are, in general, ſtronger, and leſs ſubject to reſtraint, than thoſe of man. The reaſon is plain: They have not an equal number of inſtincts to curb, counterbalance, or moderate their motives to particular actions. Hence they have often the appearance of acting by mere impulſe; and this circumſtance has led ſome philoſophers to conſider brutes as machines. But they reflect not that children, ſavages, and ignorant men, act nearly in the ſame manner. It is ſociety and culture which ſoften and moderate the paſſions and actions of men, as well as thoſe of docile animals.

Brutes, like men, learn to ſee objects in their proper poſition, to judge of diſtances and heights, and of hurtful, pleaſureable, or indifferent bodies. Without ſome portion of reaſon, therefore, they could never acquire the faculty of making a proper uſe of their ſenſes. A dog, though preſſed with hunger, will not ſeize a piece of meat in preſence of his maſter, unleſs it be given to him: But, with his eyes, his movements, and his voice, he makes the moſt humble and expreſſive petition. If this balancing of motives be not reaſoning, I know not by what other name it can be called.

Animals, recently after birth, know not how to avoid danger. Neither can they make a proper uſe of their members. But experience ſoon teaches them what is pleaſant and what is painful, what objects are hurtful and what ſalutary. A young cat, or a dog, who has had no experience of leaping from a height, will, without heſitation, precipitate itſelf from the top of a high wall. But, after perceiving that certain heights are hurtful, and others inoffenſive, the animal learns to make the diſtinction, and never afterwards can be prevailed upon to leap from a height which it knows will be productive of pain.

Young animals examine every object they meet with. In this inveſtigation they employ all their organs. The firſt periods of their life are dedicated to ſtudy. When they run about, and make frolickſome gambols, it is Nature ſporting with them for their inſtruction. In this manner they improve their faculties and organs, and acquire an intimate knowledge of the objects which ſurround them. Men who, from peculiar circumſtances, have been prevented from mingling with companions, and engaging in the different amuſements and exerciſes of youth, are always awkward in their movements, cannot uſe their organs with eaſe or dexterity, and often continue, during life, ignorant of the moſt common objects.

From the above facts and reaſoning, it ſeems to be apparent, that inſtincts are original qualities of mind; that every animal is poſſeſſed of ſome of theſe qualities; that the intelligence and reſources of animals are proportioned to the number of inſtincts with which their minds are endowed; that all animals are, in ſome meaſure, rational beings; and that the dignity and ſuperiority of the human intellect are neceſſary reſults, not of the conformation of our bodies, but of the great variety of inſtincts which Nature has been pleaſed to confer on the ſpecies.

CHAPTER VI.

Of the Senſes.

NO animal of which we have any knowledge is endowed with more than the five external ſenſes of ſmelling, taſting, hearing, touch, and ſeeing; and no animal, however imperfect, is deſtitute of the whole. Without organs of ſenſation, in a ſmaller or greater number, animal or intellectual exiſtence is to us an inconceivable idea. Hence the notion of the ancients, and of a very few moderns, that this earth, as well as all the heavenly bodies, are intelligent beings, though they have not the veſtige of any inſtrument of ſenſation, or of any thing analogous to our ideas of animation, except mechanical motion, is too abſurd even to be ſeriouſly mentioned.

Upon this intereſting ſubject, as it comprehends every ſource of information, and every motive to action in man, as well as in the inferior animals, it is not ſurpriſing that ſo much has been written, and that ſo many different theories have been invented, and ſubmitted to public inſpection. Some of theſe theories ſhall be taken notice of in a curſory manner, and others, as unworthy of attention, ſhall be paſſed over in ſilence.

Our obſervations on the different inſtruments of ſenſation ſhall proceed in the following order, namely, of the ſenſes of ſmelling, of taſting, of hearing, of touch, and of ſeeing. In general, it may be remarked, that all ſenſation is conveyed to the mind by an unknown influence of the nerves. If the optic, olfactory, or any nerve diſtributed over an organ of ſenſation, be cut, or rendered paralytic, the animal inſtantly loſes that particular ſenſe. This is a fact univerſally eſtabliſhed by experiment. But that the nerves, which are perfectly ſimilar in every part of the body, ſhould, when diſtributed over the eye, the ear, the tongue, the noſe, convey to the mind feelings ſo different, is the moſt myſterious part of this ſubject. When M. de Bonnet tells us, that every organ of ſenſe probably conſiſts of fibres ſpecifically different; and that theſe fibres are particular ſenſes endowed with a peculiar manner of acting, correſponding to the perceptions they excite in the mind;—he means to reaſon; but he does no more than give a circumlocution for the fact.

OF SMELLING.

IN man, and many other animals, the organ by which the ſenſe of ſmelling is conveyed to the mind, has received the general appellation of *noſe*, or *noſtrils*. The more immediate inſtrument of this ſenſation is a ſoft, vaſcular, porous membrane, covered with numerous papillae, and is known by the name of *membrana pituitaria*, or *membrana Schneideriana*. This membrane is totally covered with infinite ramifications and convolutions of the olfactory nerves. Theſe nerves are almoſt naked, and expoſed to the action of the air which paſſes through the noſe in performing the function of reſpiration. But Nature, ever attentive to the eaſe and convenience of her creatures, has furniſhed the noſtrils with a number of glands, or ſmall arteries, which ſecrete a thick inſipid mucus. By this mucus, the olfactory nerves are defended from the action of the air, and from the painful ſtimuli of acrid odours.

The odours perceived by ſmelling are extremely various. Some of them convey to us the moſt delightful and refreſhing ſenſations, and others are painful, noxious, and diſguſting. All bodies in Nature, whether ſolid or fluid, whether animated or inanimated, continually ſend forth to the air certain effluvia or emanations from their reſpective ſubſtances. Theſe effluvia float in the atmoſphere, and act upon the olfactory nerves of different animals, and ſometimes of different individuals of the ſame ſpecies, in ſuch a manner as to produce very different ſenſations. What is pleaſant to the noſtrils of one animal is highly offenſive to thoſe of another. Brute animals ſelect their food chiefly by employing the ſenſe of ſmelling, and it ſeldom deceives them. They eaſily diſtinguiſh noxious from ſalutary food; and they carefully avoid the one, and uſe the other for nouriſhment. The ſame thing happens with regard to the drink of animals. A cow, when it can be obtained, always repairs to the cleareſt and freſheſt ſtreams; but a horſe, from ſome inſtinctive impulſe, uniformly raiſes the mud with his feet, and renders the water impure, before he drinks.

In the ſelection of food, men are greatly aſſiſted, even in the moſt luxurious ſtate of ſociety, by the ſenſe of ſmelling. By ſmelling we often reject food as noxious, and will not riſk the other teſt of taſting. Victuals which have a putrid ſmell, as equally offenſive to our noſtrils as hurtful to our conſtitutions, we avoid with abhorrence; but we are allured to eat ſubſtances which have a grateful and ſavoury odour. The more frequent and more acute diſcernment of brutes in the exerciſe of this ſenſe, is entirely owing to their freedom, and to their uſing natural productions alone. But men in ſociety, by the arts of cookery, by the unnatural aſſemblage of twenty ty ingredients in one diſh, blunt, corrupt, and deceive both their ſenſes of ſmelling and of taſting. Were we in the ſame natural condition as the brutes, our ſenſe of ſmelling would enable us to diſtinguiſh, with equal certainty, noxious from ſalutary food. Brutes, as well as men, prefer particular foods to others. This may be conſidered as a ſpecies of luxury; but it ſhould likewiſe be conſidered, that all the articles they uſe are either animal or vegetable ſubſtances in a natural ſtate, neither converted into a thouſand forms and qualities by the operation of fire and water, nor having their ſavour exalted by ſtimulating condiments. Domeſtic animals are nearly in the ſame condition with luxurious men. A pampered dog ſnuffs and rejects many kinds of food, which, in a natural ſtate, he would devour with eagerneſs.

It is not unworthy of remark, that, in all animals, the organs of ſmelling and of taſting are uniformly ſituated very near each other. Here the intention of Nature is evident. The vicinity of theſe two ſenſes forms a double guard in the ſelection of food. Were they placed in diſtant parts of the body, they could not ſo readily give mutual aid to one another.

But aſſiſtance in the choice of food is not the only advantage that men and other animals derive from the ſenſe of ſmelling. Every body in nature, whether animal, vegetable, or mineral, when expoſed to the air, continually ſends forth emanations, or effluvia, of ſuch extreme ſubtilty, that no eye can perceive them. Theſe effluvia, or volatile particles, diffuſe themſelves through the air, and moſt of them are recogniſed, by the organ of ſmelling, to be either agreeable or diſagreeable. To give ſome idea of the inconceivable minuteneſs of theſe particles, and of the amazing ſenſibility of the noſtrils of animals, the odour of muſk has been known to fill a large ſpace for ſeveral years without loſing any perceptible part of its weight. Thus, the air we breathe is perpetually impregnated with an infinity of different particles which ſtimulate the olfactory nerves, and give riſe to the ſenſation of ſmell. When our ſenſes are not vitiated by unnatural habits, they are not only faithful monitors of danger, but convey to us the moſt exquiſite pleaſures. Even the ſenſe of ſmelling is always productive either of pleaſure or pain. The fragrance of a roſe, and of many other flowers, is not only pleaſant, but gives a refreſhing and delightful ſtimulus to the whole ſyſtem, and may be conſidered as a ſpecies of wholeſome nouriſhment; while the odours proceeding from hemlock, and from many other noxious vegetable, animal, and mineral ſubſtances, are highly offenſive to our noſtrils. Hence we are naturally compelled to embrace the one claſs of ſenſations and to avoid the other.

Some animals, as the dog, the fox, the raven, &c. are endowed with a moſt exquiſite ſenſe of ſmelling. A dog ſcents various kinds of game at conſiderable diſtances; and, if the fact were not confirmed by daily experience, it could hardly gain credit, that he can trace the odour of his maſter's foot through all the winding ſtreets of a populous city. If we judge from our own feelings, this extreme ſenſibility in the noſe of a dog is to us perfectly incomprehenſible.

The ſenſe of ſmelling, like that of ſome other ſenſes, may be perverted or corrupted by habit. The ſnuffing, chewing, and ſmoking tobacco, though at firſt diſagreeable, become, by the power of habit, not only pleaſant, but almoſt indiſpenſible. The ſame remark is applicable to the practice of ſwallowing ardent ſpirits, the moſt deleterious of all poiſons, becauſe the moſt extenſively employed. How the natural ſtate of the nerves, and of the ſenſations conveyed by them, ſhould be ſo completely changed, we are totally ignorant. The conſtitution of the nerves often varies in different individuals of the ſame ſpecies. An odour which is diſguſtful to one man is highly grateful to another. I knew a gentleman who was in the daily habit of lighting and putting out candles, that he might enjoy the pleaſure of their ſmell. Few men, I ſuppoſe, would envy him.

OF TASTING.

THE tongue and palate are the great inſtruments of this ſenſation. With much wiſdom and propriety the organ of taſte is ſituated in ſuch a manner as enables it to be a guardian to the alimentary canal, and to aſſiſt the organ of ſmell in diſtinguiſhing ſalutary from noxious food. The tongue, like the other inſtruments of ſenſation, is amply ſupplied with nerves. The terminations of theſe nerves appear on the ſurface of the tongue in the form of *papillae*, or minute nipples, which are always erected on the application of ſapid or ſtimulating ſubſtances. This elevation and extenſion of the papillae, by bringing larger portions of the nerves into contact with the ſubſtances applied to the tongue, give additional ſtrength to the ſenſation, and enable us to judge with greater accuracy concerning their nature and qualities. Beſide the nervous papillae, the tongue is perpetually moiſtened with ſaliva, a liquor which, though inſipid itſelf, is one great cauſe of all taſtes. The ſaliva of animals is a very powerful ſolvent. Every ſubſtance applied to the tongue is partially diſſolved by the ſaliva before the ſenſation of taſte is excited. When the tongue is rendered dry by diſeaſe, or any other cauſe, the ſenſe of taſte is either vitiated or totally annihilated.

In ſome men, the ſenſe of taſte is ſo blunt, that they cannot diſtinguiſh with any degree of accuracy the different ſpecies of that ſenſation. In others, whether from Nature or from habit, this ſenſe is ſo acute, that they can perceive the niceſt diſtinctions in the ſavour of ſolids and of liquids.

The ſenſations conveyed to the mind by taſte, like thoſe of all the ſenſes, are either agreeable, diſagreeable, or indifferent. The pleaſures ariſing from this ſenſe are not only great, but highly uſeful to every animal. The ſenſe itſelf, however, is comparatively groſs; for, in ſmelling, hearing, and ſeeing, ſenſations are excited by emanations or undulations proceeding from bodies at great diſtances from the animals who perceive them. But, in taſting, the object muſt be brought into actual contact with the tongue before its qualities can be diſcovered. How this proportionally groſs ſenſe ſhould have been ſelected, and figuratively applied to the general perception of every thing beautiful and ſublime, whether in Nature or in art, it is difficult to determine. The inquiry, however, would not be incurious, whether men who have an obtuſe ſenſe of taſting material ſubſtances are likewiſe deficient in the perception of beauty and deformity.

Though the ſenſe of taſte varies in ſome individuals, yet, like figurative taſte, the ſtandard of agreeable and diſagreeable, of pleaſant and painful, is almoſt univerſally diffuſed over mankind and the brute creation. Every horſe, and every ox, when in a natural ſtate, eat and reject the ſame ſpecies of food. But men in ſociety, as well as domeſtic animals, are induced by habit, by neceſſity, or by imitation, to acquire a taſte for many diſhes, and combinations of ſubſtances, which, before the natural diſcriminating ſenſe is perverted, would be rejected with diſguſt.

Some individuals of the human ſpecies have an averſion to particular kinds of food, which are generally agreeable. This averſion may be either original or acquired. I knew a child, who, from the moment he was weaned, could never be induced to take milk of any kind. Theſe original averſions muſt be aſcribed to ſome peculiar modification in the ſtructure of the organ, or in the diſpoſition of its nerves. But, in general, diſguſt at particular foods is produced by ſurfeits, which injure the ſtomach, and create, in that exquiſitely irritable viſcus, an inſuperable antipathy to receive nouriſhment which formerly gave it ſo much uneaſineſs to digeſt.

Brute animals, eſpecially thoſe which feed upon herbage, and are not liable to be corrupted by example or neceſſity, diſtinguiſh taſtes with wonderful accuracy. By the application of the tongue, they inſtantly perceive whether any plant is ſalutary or noxious. To enable them, amidſt a thouſand plants, to make this diſcrimination, their nervous papillae, and their tongues, are proportionally much larger than thoſe of man.

OF HEARING.

THE ſenſation of hearing is conveyed to the mind by undulations of air ſtriking the ear, an organ of a very delicate and complex ſtructure. In man and quadrupeds, the external ears are large, and provided with muſcles by which they can erect and move them from ſide to ſide, in order to catch the undulations produced in the air by the vibrations of ſonorous bodies, or to diſtinguiſh with greater accuracy the ſpecies of ſound, and the nature and ſituation of the animal or object from which it proceeds. Though the human ears, like thoſe of quadrupeds, are furniſhed with muſcles, evidently intended for ſimilar movements, yet, I know not for what reaſon, there is not one man in a million who has the power of moving his ears. When we liſten to a feeble ſound, we are conſcious of an exertion; but that exertion, and the motions produced by it, are confined to the internal parts of the organ.

The canals or paſſages to the internal parts of the ear are cylindrical, ſomewhat contorted, and become gradually ſmaller till they reach the *membrana tympani*, which covers what is called the drum of the ear. This membrane, which is extremely ſenſible, when acted upon by indulations of air, however excited, conveys, by means of a complex apparatus of bones, nerves, &c. the ſenſation of ſound to the brain or ſentient principle.

That air is the medium by which all ſounds are propagated, has been eſtabliſhed by repeated experiments. The ſound of a bell, ſuſpended in the receiver of an air-pump, gradually diminiſhes as the air is exhauſted, till it almoſt entirely ceaſes to be heard. On the other hand, when the quantity of air is increaſed by a condenſer, the intenſity of the ſound is proportionally augmented. Mr Haukſbee, in a paper publiſhed in the Philoſophical Tranſactions, has proved, that ſounds actually produced cannot be tranſmitted through a *vacuum*, or a ſpace deprived of air. 'I took,' ſays he, 'a ſtrong receiver, armed with a braſs hoop at the bottom, in which 'I included a bell as large as it could well contain. This receiver 'I ſcrewed ſtrongly down to a braſs plate with a wet leather between, and it was full of common air, which could nowiſe make 'its eſcape. Thus ſecured, it was ſet on the pump, where it was 'covered with another large receiver. In this manner, the air contained between the outward and inward receivers was exhauſted. 'Now here I was ſure, when the clapper ſhould be made to ſtrike 'the bell, there would be actually ſound produced in the inward 'receiver; the air in which was of the ſame denſity as common air, 'could ſuffer no alteration by the *vacuum* on its outſide, ſo ſtrongly was it ſecured on all parts. Thus, all being ready for trial, the 'clapper was made to ſtrike the bell; but I found that there was no 'tranſmiſſion of it through the *vacuum*, though I was ſure there 'was actual ſound produced in the inward receiver.'

To enable us to underſtand the manner in which ſounds are propagated through the air, philoſophers have had recourſe to the undulations produced by a ſtone thrown into a pond of ſtagnating water. Theſe undulations aſſume the form of circular waves, which ſucceſſively proceed from the place where the ſtone ſtruck the water, as from a center, and continually dilate, and become greater and greater as they recede from that center, till they reach the banks of the water, where they either vaniſh or are reflected. Now, as air is likewiſe a fluid, ſimilar undulations, though to us inviſible, are produced in it by the vibrations of ſonorous bodies, and are alſo propagated to great diſtances in ſucceſſive waves or rings. Theſe undulations of the air, when they come into contact with our organs of hearing, make ſuch a tremulous impreſſion upon them as excites in our minds the ſenſation of ſound. This analogy, though not altogether perfect, is ſufficient to illuſtrate thoſe inviſible motions of the air by which ſounds are conveyed from one place to another, and to give an idea of echoes, or reflected undulations of that fluid.

The celerity with which ſounds, or undulations of air, move, has been exactly computed. All ſounds, whether acute or grave, ſtrong or weak, move at the rate of 1142 feet in a ſecond of time. Hence, whenever the lightning of thunder, or the fire of artillery, are ſeen, their actual diſtances from the obſerver may be eaſily aſcertained by the vibrations of a pendulum. This velocity, it is true, may be a little augmented or diminiſhed by favourable or by contrary winds, and by heat or cold. But the difference, even in high winds, is ſo trifling, that, for any uſeful purpoſe, it ſcarcely merits attention.

Infants hear bluntly, becauſe the bones of their ears are ſoft and cartilaginous; and, of courſe, the tremulations excited in them by the motions of the air are comparatively weak. Young children, accordingly, are extremely fond of noiſe. It rouſes their attention, and conveys to them the agreeable ſenſation of ſound; but feeble ſounds are not perceived, which gives infants, like deaf perſons, the appearance of inattention, or rather of ſtupidity.

The force or intenſity of ſound is augmented by reflection from ſurrounding bodies. It is from this cauſe that the human voice, or any other noiſe, is always weaker, and leſs diſtinctly heard, in the open air than in a houſe.

The modifications of ſound are not leſs various than thoſe of taſtes or odours. The ear is capable of diſtinguiſhing ſome hundred tones in ſound, and probably as many degrees of ſtrength in the ſame tones. By combining theſe, many thouſand ſimple ſounds, which differ either in tone or in ſtrength, are perceived and diſtinguiſhed by the ear. A violin, a flute, a French-horn, may each of them give the ſame tone; but the ear eaſily makes the diſtinction. The immenſe variety of ſenſations, ariſing from the organs of ſmelling, of taſting, and of hearing, enables animals to judge concerning the nature and ſituation of external objects. By habit we learn to know the bodies from which particular ſpecies of ſounds proceed. Previous to all experience, we could not diſtinguiſh whether a ſound came from the right or the left, from above or below, from a greater or a ſmaller diſtance, or whether it was the ſound of a coach, of a drum, of a bell, or of an animal. By catching cold, I once had a temporary deafneſs in my left ear. I was ſurpriſed to find that I had loſt the faculty of perceiving the ſituation from which ſounds proceeded. If a dog barked on the left, I thought the noiſe came from the right. This circumſtance excited my curioſity: But, upon recollection, I knew that my left ear was deaf; and that every ſound I heard was perceived ſolely by the right; and, conſequently, I diſcovered the cauſe of the deception.

Hearing enables us to perceive all the agreeable ſenſations conveyed to our minds by the melody and harmony of ſounds. This, to man at leaſt, is a great ſource of pleaſure and of innocent amuſement. But ſome men are almoſt totally deſtitute of the faculty of diſtinguiſhing muſical ſounds, and of perceiving thoſe delightful and diverſified feelings excited by the various combinations of muſical tones. Moſt men derive pleaſure from particular ſpecies of muſic. But a muſical ear, in a reſtricted ſenſe, is by no means a general qualification. An ear for muſic, however, though not to be acquired by ſtudy, when the faculty itſelf is wanting, may be highly improved by habit and culture. Buffon, after examining a number of perſons who had no ear for muſic, ſays, that every one of them heard worſe in one ear than in the other; and aſcribes their inability of diſtinguiſhing muſical expreſſion to that defect. But a muſical ear ſeems to have no dependence on acuteneſs or bluntneſs of hearing, whether in one or in both ears. There are many examples of people who may be ſaid to be half deaf, and yet are both fond of muſic, and ſkilful practitioners. An ear for muſic, like a genius for painting or poetry, is a gift of Nature, and is born with the poſſeſſor.

Beſide the innumerable pleaſures we derive from muſic and agreeable ſounds, the extenſion and improvement of *artificial* language muſt be conſidered as objects of the greateſt importance to the human race. Without the ſenſe of hearing, mankind would forever have remained mute. I mention *artificial*, or improved language, becauſe, from a thouſand obſervations which every perſon muſt have made, it is perfectly apparent, that, if deſtitute of a *natural* language, neither man nor the brute creation * could poſſibly have exiſted and

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* Concerning the language of beaſts, I ſhall, perhaps, be more explicit in a future work.

continued their ſpecies. As brutes, without information or experience, are capable of communicating to each other, by particular ſounds and geſtures, their pleaſures and pains, their wants and deſires, it would be the higheſt abſurdity to ſuppoſe that the great Creator ſhould have denied to man, the nobleſt animal that inhabits this globe, the ſame indiſpenſible privilege. Without a baſis there can be no fabric. Without a *natural* no *artificial* language could poſſibly have exiſted. This point is clearly demonſtrated, in a few words, by that moſt ingenious, candid, and profound philoſopher, Dr Thomas Reid, Profeſſor of Moral Philoſophy in the Univerſity of Glaſgow. ‘If mankind,’ ſays Dr Reid, ‘had not a *natural* language, they could never have invented an artificial one by their ‘reaſon and ingenuity. For all artificial language ſuppoſes ſome ‘compact or agreement to affix a certain meaning to certain ſigns; ‘therefore, there muſt be compacts or agreements before the uſe of ‘artificial ſigns; but there can be no compact or agreement without ‘ſigns, nor without language; and therefore there muſt be a natural language before any artificial language can be invented *.’ Let any man try to overturn this argument, which is founded, not upon *metaphyſical* conjecture, but upon the ſolid baſis of *fact* and uncontrovertible *reaſoning*. The elements, or conſtituent parts of the natural language of mankind, the Doctor reduces to three kinds; modulations of the voice, geſtures, and features. ‘By means of ‘theſe,’ ſays he, ‘two ſavages, who have no common artificial language, can converſe together; can communicate their thoughts in ‘ſome tollerable manner; can aſk and refuſe, affirm and deny, ‘threaten and ſupplicate; can traffic, enter into covenants, and ‘plight their faith.’

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* Doctor Reid's Inquiry into the Human Mind, on the Principles of Common Senſe, pag. 93.

I can perceive only one plauſible objection to this reaſoning. If, it may be ſaid, man were endowed with a natural language, this language muſt be univerſal; from what ſource, then, can the great diverſity of languages in different nations, and tribes of the human race, be derived? The ſolution of this queſtion depends not upon metaphyſical arguments, but upon fact and experience. I have had conſiderable opportunities of obſerving the behaviour of children. Infants, when very young, have nearly the ſame modes of expreſſing their pleaſures and pains, their deſires and averſions. Theſe they communicate by voice, geſture, and feature; and every infant, whatever be the country, climate, or language, uniformly expreſſes its feelings almoſt in the ſame manner. But, when they arrive at nine or twelve months of age, a different ſcene is exhibited. They then, beſide the general expreſſions of feeling and deſire, attempt to give names to particular objects. Here artifice begins. In theſe attempts, previous to the capacity of imitating articulate ſounds, every individual infant utters different ſounds, or rather gives different names, to ſignify the ſame objects of its deſire or averſion. Beſide this natural attempt towards a nomenclature, infants, during the period above mentioned, (for the time varies according to the health and vivacity of the child), frequently make continued orations. Theſe orations conſiſt both of articulate and inarticulate ſounds, of which no man can give an idea in writing. But moſt men, and every woman who has nurſed children, will perfectly underſtand what I cannot expreſs. From the fact, that children actually utter different ſounds, or give different names to denote the ſame objects, I imagine, ariſes all that diverſity of languages, which, by exhauſting time and attention, retard the progreſs and improvement both of Art and Science. If any number of children, or of ſolitary ſavages, ſhould chance to aſſociate, the names of objects would ſoon be ſettled by imitation and conſent. By obſervation and experience the number of names would be augmented, as well as the qualities or attributes of the objects themſelves; and, in the progreſs of time, a new and artificial language would be gradually formed. While this operation is going on in one corner of a country, twenty ſimilar aſſociations and compacts may be forming, or already formed, in different nations, or in different diſtricts of the ſame nation, all of which would give birth to ſeparate artificial languages.

OF TOUCH.

THE ſenſations of ſmelling, taſting, hearing, and ſeeing, are conveyed to us by partial organs, which are all confined to the head. But the ſenſe of touching, or of feeling, is not only common to theſe organs, but extends over almoſt every part of the body, whether external or internal. Though every ſenſation may be comprehended under the general appellation of *feeling*, yet what is called the ſenſe of *touch* is properly reſtricted to the different ſenſations excited by bodies applied to the ſkin, and particularly to the tips of the fingers.

With regard to ſenſation in general, it is worthy of remark, that the eyes, the ears, the noſtrils, the tongue and palate, the palms of the hands, eſpecially towards the points of the fingers, are more amply ſupplied with nerves than any other external parts of the body. The terminations of the nerves on the ſurface of the ſkin are ſoft and pulpy, and form minute protuberances reſembling the nap of freeze-cloth, though greatly inferior in magnitude. Theſe protuberances have received the denomination of *nervous papillae*. They might be called *animal feelers;* for they are obviouſly the immediate inſtruments of ſenſation. If an object be preſented to the eye, or any other organ of ſenſation, certain feelings are excited, which are either agreeable or diſagreeable, according to the real or imaginary qualities which we conſider as belonging to that object.

The feelings thus excited inſtantly produce a change in the ſenſitive organs by which they are occaſioned. If the object be poſſeſſed of diſagreeable qualities, averſion is the neceſſary conſequence. But, if beauty and utility are perceived in the object, pleaſant emotions ſpring up in the mind, which naturally induce a ſimilar tone or diſpoſition in the organs ſuited for the enjoyment of theſe qualities.

When examining or enjoying any object, it is natural to inquire, what are the changes produced in the nervous papillae, or organs of ſenſation? If an object poſſeſſed of agreeable feelings is perceived, the nervous papillae inſtantly extend themſelves, and, from a ſtate of flaccidity, become comparatively rigid like briſtles. This extenſion of the papillae is not conjectural: It is founded on anatomical obſervation, and, in ſome caſes, may be ſeen and felt by perſons of acute and diſcerning ſenſations. When a man in the dark inclines to examine any ſubſtance, in order to diſcover its figure, or other qualities, he perceives a kind of rigidity at the tips of his fingers. If the fingers are kept long in this ſtate, the rigidity of the nervous papillae will give him a kind of pain or anxiety, which it is impoſſible to deſcribe. The cauſe of this pain is an over-diſtenſion of the papillae. If a ſmall inſect creeps on a man's hand, when the papillae are flaccid, its movements are not perceived: But, if he happens to direct his eye to the animal, he immediately extends his papillae, and feels diſtinctly all its motions. If a body be preſent, which, in the common ſtate of the nerves, has ſcarcely any ſenſible odour, by extending the papillae of the noſtrils, an agreeable, diſagreeable, or indifferent ſmell will be perceived. When two perſons are whiſpering, and we wiſh to know what is ſaid, we ſtretch the papillae, and the other organs of hearing, which are exceedingly complex. If a ſound is too low for making an impreſſion on the papillae in their natural ſtate of relaxation, we are apt to overſtretch the organ, which produces a painful or irkſome feeling. When we examine a mite, or any very minute object, by the naked eye, a pain is propagated over every part of that organ. Several cauſes may concur in producing this pain, ſuch as the dilating of the pupil, and the adjuſting the chryſtalline lens; but the chief cauſe muſt be aſcribed to the preternatural intumeſcence and extenſion of the papillae of the retina, the ſubſtance of which is a mere congeries of nervous terminations. This circumſtance confirms a former remark, that the immediate organs of ſenſation were more copiouſly ſupplied with nervous papillae than thoſe parts whoſe uſes require not ſuch exquiſite ſenſibility; for a diſtinction in this reſpect is obſervable even among the ſenſitive organs themſelves. They are furniſhed with nerves exactly proportioned to the ſubtility of the objects whoſe impreſſions they are fitted to receive. The eye poſſeſſes by far the greateſt number. The particles of light are ſo minute, that, had not this wiſe proviſion been obſerved in the conſtruction of the eye, it could never have been able to diſtinguiſh objects with ſuch accuracy as at preſent it is capable of performing. When an inſipid body, or a body which conveys but a very feeble ſenſation of taſte, is applied to the tongue, we are conſcious of an effort which that organ makes in order to diſcover the quality of the body thus applied. This effort is nothing but the ſtretching of the nervous papillae, that they may enlarge the field of contact with the body under examination.

The pleaſure or pain produced by the ſenſe of touch depends chiefly on the friction, or number of impulſes, made upon the papillae. Embrace any agreeable body with your hand, and allow it to remain perfectly at reſt, and you will find the pleaſure not half ſo exquiſite as when the hand is gently moved backward and forward upon the ſurface. Apply the hand to a piece of velvet, and it is merely agreeable: Rub the hand repeatedly on the ſurface of the cloth, and the pleaſant feeling will be augmented in proportion to the number of impulſes on the papillae. When a man is pinched with hunger, the ſight or idea of palatable food raiſes the whole papillae of his tongue and ſtomach. From this circumſtance he is highly regaled by eating. But, if he eats the ſame ſpecies of food when his ſtomach is leſs keen, the pleaſure in the one caſe is not to be compared with what is felt in the other. The cauſe is obvious: His deſire was not ſo urgent; the object, of courſe, was leſs alluring; and therefore he was more remiſs in erecting his papillae, or in putting them in a tone ſuited to ſuch eminent gratification.

The ſame obſervations are applicable to diſagreeable or painful objects of contact. If the hand is laid upon a gritty ſtone, or a piece of ruſty iron, the feeling is diſagreeable; but if it is frequently rubbed upon the ſurface of theſe bodies, the feeling becomes inſufferably irkſome.

It is by the ſenſe of touch that men, and other animals, are enabled to perceive and determine many qualities of external bodies. By this ſenſe we acquire the ideas of hardneſs and ſoftneſs, of roughneſs and ſmoothneſs, of heat and cold, of preſſure and weight, of figure, and of diſtance. The ſenſe of touch is more uniform, and liable to fewer deceptions, than thoſe of ſmelling, taſting, hearing, and ſeeing; becauſe, in examining the qualities of objects, the bodies themſelves muſt be brought into actual contact with the organ, without the intervention of any medium, the variations of which might miſlead the judgment.

OF SEEING.

OF all the ſenſes, that of ſeeing is unqueſtionably the nobleſt, the moſt refined, and the moſt extenſive. The ear informs us of the exiſtence of objects at comparatively ſmall diſtances; and its information is often imperfect and fallacious. But the organ of ſight, which is moſt admirably conſtructed, not only enables us to perceive thouſands of objects at one glance, together with their various figures, colours, and apparent poſitions, but, even when unarmed, to form ideas of the ſun and planets, and of many of the fixed ſtars; and thus connects us with bodies ſo remote, that imagination is loſt when it attempts to form a conception of their immenſe magnitude and diſtances. This natural field of viſion, however great, has been vaſtly extended by the invention of optical inſtruments. When aided by the teleſcope, the eye penetrates into regions of ſpace, and perceives ſtars innumerable, which, without the aſſiſtance of art, would to us have no exiſtence. Our ideas of the beauty, magnitude, and remoteneſs or vicinity of external objects, are chiefly derived from this delicate and acute inſtrument of ſenſation.

Before proceeding to the peculiarities of viſion, and the general properties of light, we ſhall give a ſhort deſcription of the ſtructure of the eye.

The globe of the eye is compoſed of three humours, called *aqueous*, *cryſtalline*, and *vitreous*; and of the *retina*, *ciliary ligament*, and *iris*. All theſe are contained within the *ſclerotica* and *cornea*, or capſule of the eye. The white part of the cornea is opaque; but the *pupil*, or *ſight* of the eye, through which the rays of light paſs, is tranſparent. The *aqueous humour* is a *meniſcus*, or a convex exteriorly, and concave internally. The *cryſtalline humour* is doubly convex; and its exterior convexity is embraced by the concave ſurface of the aqueous. The *vitreous* humour is likewiſe a meniſcus; its concave ſurface embraces the interior convexity of the cryſtalline, and its convex ſurface is encompaſſed by the *retina*, which is a fine expanſion of the medullary fibres of the optic nerve ſpread upon the convex ſurface of the vitreous humour, and covering the bottom of the eye. The *ciliary ligament* is a ring of fibres, which incloſe the edges of the cryſtalline, and ſtretch in right lines towards its center. When theſe fibres contract, the diſtance between the retina and cryſtalline is lengthened; and that diſtance is ſhortened when theſe fibres are in a relaxed ſtate. The *iris* is that coloured circle which ſurrounds the pupil.

By this curious apparatus all the phaenomena of viſion are conveyed to the mind. But, before we enter upon the manner in which the different parts of the eye concur in tranſmitting the rays of light and the images of objects to the retina, it will be neceſſary to give ſome general ideas concerning the nature of light, which is the univerſal medium of viſion.

Light conſiſts of innumerable rays, which proceed in direct lines from every part of luminous bodies. The motion of light, though not inſtantaneous, is inconceivably ſwift. To give ſome comparative idea of its great velocity, it has been diſcovered by philoſophers, that rays of light coming from the ſun reach this earth in ſeven minutes. Now, the diſtance of the earth from the ſun is ſo immenſe, that, ſuppoſing a cannon ball to move at the rate of 500 feet in a ſecond, it could not come from the ſun to the earth in leſs than 25 years. At this rate, the velocity of light will be above 10 million of times greater than that of a cannon ball.

The rays of light, though they proceed in direct lines from luminous bodies, are refracted, or bent out of their courſe, in paſſing through different mediums, as the air, glaſs, and every tranſparent ſubſtances; but, when they fall upon opaque bodies, they are reflected. Rays proceeding from any object, and paſſing through a convex glaſs or lens, are refracted and collected into a point, or ſmall ſpace, at a certain diſtance from the glaſs, which is called the *focus* of that lens.

The white light conveyed to us by the ſun is not homogeneous, but conſiſts of ſeven differently coloured rays, or what are called the *primary colours*. Theſe differently coloured rays were diſcovered by Sir Iſaac Newton to have different degrees of refrangibility. When the white light of the ſun was made to paſs through a glaſs priſm, he found, that, inſtead of retaining its original whiteneſs, it exhibited ſeven diſtinct colours, and that this phaenomenon was produced by the ſeveral rays in the compoſition of white light being more or leſs refracted, or turned from their direct courſe. The ſimple primary colours are ſeven in number, namely, red, orange, yellow, green, blue, indigo, and violet. Red is the leaſt, and violet the moſt refrangible parts of white light. A proper mixture of all the ſeven primary colours conſtitutes whiteneſs; and by various combinations of the primary colours, all the compound colours exhibited either in Nature or art are produced. Any ſurface appears black when it reflects little or no light.

The different humours of the eye, and the cryſtalline lens, are all denſer than air or water; of courſe, their power of refracting the rays of light is likewiſe greater. The rays proceeding from every point of an object enter the pupil; and the refraction of the different parts of the eye, which act as a lens, neceſſarily makes them croſs each other in their paſſage to the retina. After croſſing, they diverge till they are ſtopped by the retina, where they form an inverted picture. The upper part of the object is painted on the lower part of the retina, and the right ſide upon the left, &c. The celebrated Kepler firſt diſcovered, that diſtinct, but inverted pictures of every object we behold are painted on the retina by the rays of light proceeding from viſible objects. This diſcovery naturally led

Kepler, as well as many other philoſophers ſince his time, to inquire how we ſhould ſee objects erect from inverted images on the retina.

Many ingenious theories have been invented, and many volumes have been written, in order to explain this ſeemingly difficult queſtion. To give even a curſory view of theſe theories would not only be tedious, but in a great meaſure uſeleſs. We ſhall therefore only remark, that their authors uniformly aſſumed it as a principle, that, becauſe the pictures are inverted on the retina, the mind ought alſo to perceive them in the ſame poſition. It is certain, that, unleſs diſtinct images are painted on the retina, objects cannot be clearly perceived. If, from too little light, remoteneſs, or any other cauſe, a picture is indiſtinctly painted on the retina, an obſcure or indiſtinct idea of the object is conveyed to the mind. The picture on the retina, therefore, is ſo far the cauſe of viſion, that, unleſs this picture be clear and well defined, our ideas of the figure, colour, and other qualities of any object preſented to the eye, will be obſcure and imperfect. The retina of the eye reſembles a canvas on which objects are painted. The colours of theſe pictures are bright or obſcure, in proportion to the diſtances of the objects repreſented. When objects are very remote, their pictures on the retina are ſo faint, that they are entirely obliterated by the vigorous and lively impreſſions of nearer objects, with which we are every way ſurrounded. On the other hand, when near objects emit a feeble light only, compared with that which proceeds from a remote object, as, for example, when we view luminous bodies in the night, then very diſtant objects make diſtinct pictures on the retina, and become perfectly viſible. Hence a man, by placing himſelf in a dark ſituation, and looking through a long tube, without the intervention of a glaſs, may make a kind of teleſcope, which will have a conſiderable effect even during the day. For the ſame reaſon, a man at the bottom of a deep pit can ſee the ſtars at noon.

The firſt and greateſt error in viſion, in the opinion of many authors, ariſes from the inverted repreſentation of objects upon the retina; and they maintain, that, till children learn the real poſition of bodies by the ſenſe of feeling, they ſee every object inverted. But new born animals, whether of the human or brute ſpecies, ſee objects, not inverted, but in their real poſitions, independently of all experience, or of any opportunity of rectifying the ſuppoſed illuſion by the ſenſe of touch. Animals ſee objects in their real poſition by a law of Nature, and by the inſtrumentality of the eye and optic nerve. Were it not a law of Nature, or of the conſtitution of animals, to ſee objects erect, though their images be inverted on the retina, an inverted object could not poſſibly appear inverted; for, in this caſe, we ſhould not be obliged to have recourſe to experience, or to the ſenſe of feeling. Beſides, it is an eſtabliſhed fact, that blind men, who had been reſtored to ſight by chirurgical operations, inſtantly ſaw objects in their real poſition *. There is no relation to the principles of optics, in the ſenſation of feeling, by which an image, painted by rays of light on ſoft white nervous terminations, is conveyed through a moſt opaque body, in a long courſe of perfect darkneſs, to the brain. Indeed, the ſenſe by which the perceiving nerves of any kind are affected, is not an image or idea of the object. The idea of redneſs has nothing in common with the leaſt refrangible portions of light ſeparated from the other ſix coloured rays of which white light is compoſed. The pain of burning repreſents not to the mind any thing of that ſwift and ſubtle matter by which the nervous threads are broken or deſtroyed. There is nothing in the idea of a ſharp ſound, from a cord of a certain length, which can inform the mind that this cord vibrates 2000 times in a ſecond †.

Another

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* Haller. Phyſiol. tom. 2. pag. 87.

† For a more ample diſcuſſion of this point, ſee Haller. Phyſiol. tom. 2.;—and Dr Reid's Inquiry.

Another queſtion with regard to viſion has been much agitated by philoſophers. Becauſe a ſeparate image of every object is painted on the retina of each eye, it was concluded, that we naturally ſee all objects double; that we learn to correct this error of viſion by the ſenſe of touching; and that, if the ſenſe of ſeeing were not conſtantly rectified by that of touching, we ſhould be perpetually deceived as to the poſition, number, and ſituation of objects. The Count de Buffon mentions the real fact, though he aſcribes it to a wrong cauſe. ‘ When two images,’ ſays he, ‘ fall on *correſponding* ‘ parts of the retinae, or thoſe parts which are always affected at the ‘ ſame time, objects appear ſingle, becauſe we are *accuſtomed* to judge ‘ of them in this manner. But, when the images of objects fall up‘ on parts of the retinae which are not uſually affected at the ſame ‘ time, they then appear double, becauſe we have not acquired the ‘ *habit* of rectifying this unuſual ſenſation. Mr Cheſſelden, in his ‘ anatomy, relates the caſe of a man who had been affected with a ‘ ſtrabiſmus, or ſquinting, in conſequence of a blow on the head. ‘ This man ſaw every object double for a long time: But he gra‘ dually learned to correct this error of viſion, with regard to objects ‘ which were familiar to him; and, at laſt, he ſaw every object ‘ ſingle as formerly, though the ſquinting was never removed. This ‘ is a proof ſtill more direct, that we really ſee all objects double, ‘ and that it is by *habit* alone we learn to conceive them to be ‘ ſingle *.’

In this, and other paſſages, the Count de Buffon has pointed out the genuine cauſe (or ultimate fact) why we ſee objects ſingle with two eyes. He tells us, that, though a diſtinct image is painted on each retina, whenever theſe images are painted on correſponding points of the retinae, an object is perceived to be ſingle. It is equally ly true, that, when one eye is diſtorted by the finger, or any other cauſe, in ſuch a manner that the images are painted on points of the retinae which do not correſpond, the object is perceived to be double. Objects which are much nearer, or much more remote, than that to which both eyes are directed, appear double. If a candle is placed at the diſtance of ten feet, and a man holds his finger at arm's-length between his eyes and the candle, when he looks at the candle, he ſees his finger double, and, when he looks at his finger, he ſees the candle double. 'In this phaenomenon,' Dr Reid properly remarks, 'it is evident to thoſe who underſtand 'optics, that the pictures of objects which are ſeen double, do not 'fall upon points of the retinae which are ſimilarly ſituated, but 'that the pictures of objects ſeen ſingle do fall upon points ſimilar'ly ſituated. Whence we infer, that as the points of the two reti'nae, which are ſimilarly ſituated with regard to the centres, do 'correſpond, ſo thoſe which are diſſimilarly ſituated do not corre'ſpond. It is to be obſerved, that although, in ſuch caſes as are 'mentioned in the laſt phaenomenon, we have been accuſtomed 'from infancy to ſee objects double which we know to be ſingle; 'yet cuſtom, and experience of the unity of the object, never take 'away this appearance of duplicity *.'

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* Buffon, vol. 3. pag. 7. Tranſlat.

The ſenſe of ſeeing, without the aid of experience, conveys no idea of diſtance. If not aſſiſted by the ſenſe of touching, all objects would ſeem to be in contact with the eye itſelf. Objects appear larger or ſmaller according as they approach or recede from the eye, or according to the angle they ſubtend. A fly, when very near the eye, ſeems to be larger than a horſe or an ox at a diſtance. Children can have no idea of the relative magnitude of objects, becauſe they have no notion of the different diſtances at which they are ſeen. It is

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* Dr Reid's Inquiry, &c. page 287.

is only after meaſuring ſpace by extending the hand, or by tranſporting their bodies from one place to another, that children acquire juſt ideas concerning the real diſtances and magnitudes of objects. Their ideas of magnitude reſult entirely from the angle formed by the extreme rays reflected from the ſuperior and inferior parts of the object: Hence every near object muſt appear to be large, and every diſtant one ſmall. But after, by touch, having acquired ideas of diſtances, the judgment concerning magnitude begins to be rectified. If we judge ſolely by the eye, and have not acquired the habit of conſidering the ſame objects to be equally large, though ſeen at different diſtances, the neareſt of two men, though of equal ſize, would ſeem to be many times larger than the fartheſt. But we know that the laſt man is equally large with the firſt; and, therefore, we judge him to be of the ſame dimenſions. Any diſtance ceaſes to be familiar to us, when the interval is vertical, inſtead of being horizontal; becauſe all the experiments by which we uſually rectify the errors of viſion, with regard to diſtances, are made horizontally. We have not the habit of judging concerning the magnitude of objects which are much elevated above or ſunk below us. This is the reaſon that, when viewing men from the top of a tower, or when looking up to a globe or a cock on the top of a ſteeple, we think theſe objects much ſmaller than when ſeen at equal diſtances in a horizontal direction. During the night, on account of the darkneſs, we have no proper idea of diſtance, and, of courſe, judge of the magnitude of objects ſolely by the largeneſs of the angle or image formed in the eye, which neceſſarily produces a variety of deceptions. When travelling in the night, we are liable to miſtake a buſh that is near us for a tree at a diſtance, or a diſtant tree for a buſh which is at hand. When benighted in a part of the country with which we are unacquainted, and, of courſe, unable to judge of the diſtance and figure of objects, we are every moment liable to all the deceptions of viſion. This is the origin of that dread which ſome men feel in the dark, and of thoſe ghoſts and horrible figures which ſo many people poſitively aſſert they have ſeen in the night. Such figures are commonly ſaid to exiſt in the imagination only; but they often have a real exiſtence in the eye; for, when we have no other mode of recogniſing unknown objects but by the angle they form in the eye, their magnitude is uniformly augmented in proportion to their vicinity. If an object, at the diſtance of twenty or thirty paces, appears to be only a few feet high, its height, when viewed within two or three feet of the eye, will ſeem to be many fathoms. Objects, in this ſituation, muſt excite terror and aſtoniſhment in the ſpectator, till he approaches and recogniſes them by actual feeling; for the moment a man examines an object properly, the gigantic figure it aſſumed in the eye inſtantly vaniſhes, and its apparent magnitude is reduced to its real dimenſions. But if, inſtead of approaching an object of this kind, the ſpectator flies from it, he retains the idea which the image of it formed in his eye, and he may affirm with truth, that he beheld an object terrible in its aſpect, and enormous in its ſize. Hence the notion of ſpectres, and of horrible figures, is founded in nature, and depends not ſolely on imagination.

When we have no idea of the diſtance of objects by a previous knowledge of the ſpace between them and the eye, we try to judge of their magnitudes by recogniſing their figures. But, when their figures are not diſtinguiſhable, we perceive thoſe which are moſt brilliant in colour to be neareſt, and thoſe that are moſt obſcure to be at the greateſt diſtance. From this mode of judging many deceptions originate. When a number of objects are placed in a right line, as lamps in a long ſtreet, we cannot judge of their proximity or remoteneſs but by the different quantities of light they tranſmit to the eye. Of courſe, if the lamps neareſt the eye happen to be more obſcure than thoſe which are more remote, the firſt will appear to be laſt, and the laſt firſt.

Before I diſmiſs this ſubject, I feel an irreſiſtible deſire of giving a ſhort view of the Abbé de Condillac's *Traité des Senſations* *; a moſt ingenious performance, which, I believe, is not very generally known in this country.

In an advertiſement prefixed to this Treatiſe, the ſagacious and learned Abbé deſires his readers to abſtract themſelves from all their preconceived opinions, and to imagine the ſituation and feelings of a ſtatue, limited, at firſt, to a ſingle ſenſe, and afterwards acquiring gradually the whole five.

1. *Senſe of Smelling alone.*

A man, or a ſtatue, who had no ſenſe but that of ſmelling, could have no other ideas than thoſe of odours. He would be the ſmell of a roſe, a violet, or a jeſſamine, according as the effluvia of theſe objects acted upon his ſingle organ of ſenſation. From agreeable or diſagreeable ſmells he would acquire ideas of pleaſure and pain. By means of agreeable and diſagreeable ſmells frequently repeated, theſe ſenſations would remain in his memory, and produce deſire and averſion. He can now compare the ſmell of a roſe with that of an hemlock.

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* From the edition 1754, in two volumes 12mo.

hemlock. As ſoon as he compares, he judges of the relation between two ideas. In proportion as theſe compariſons or judgments are repeated, he acquires, by habit, a greater facility in making them. He can judge of different degrees of pleaſure and pain. Hence, when he feels uneaſy, he recals pleaſant ſenſations which are paſt, and wiſhes for their return. This is the origin of deſire and want. Memory is the recollection only of what is paſt; but, when the ideas of objects preſent themſelves in ſo lively a manner, that he believes they are actually preſent, this operation of the mind is called imagination. Being limited to the uſe of one ſenſe, he would learn to diſtinguiſh ſmells with greater accuracy than beings endowed with more ſources of information. Abſtraction is the ſeparation of two ideas which have a natural connection. By reflecting that the ideas of pain and pleaſure reſult from different modifications of his exiſtence, he contracts the habit of ſeparating them, and thus acquires abſtract notions. To our ſtatue, a violet is a particular idea only; conſequently, all his abſtractions are limited to different degrees of pleaſure and pain. The ſucceſſion of ſenſations will give him ſome faint ideas of number, of paſt, and of future time. Duration is an idea purely relative, and changes according to the rapidity or ſlowneſs of our perceptions. Our ſtatue is incapable of diſtinguiſhing dreams, or a lively imagination, from real ſenſations. By the aid of memory he recogniſes his identity, and knows his preſent from his paſt condition. From theſe remarks it appears, that a man limited to one ſenſe is capable of acquiring the rudiments of every human faculty, and that theſe faculties are only extended by the addition of other ſenſes. Nearly the ſame acquiſitions would be made, if a man were limited to any of the other ſenſes.

2. *Of Hearing alone.*

The pleaſures of the ear ariſe chiefly from the ſucceſſion of ſounds conformably to the rules of melody or of harmony. Hence our ſtatue's deſires would not be confined to a ſingle ſound; he would wiſh to become a complete air. Sounds produce greater emotions than odours. They excite joy or ſadneſs independently of acquired ideas. Noiſe alone, without muſical expreſſion, would be agreeable: And muſic would convey pleaſure proportioned to the exerciſe of the ear. Simple, and even coarſe ſongs, would at firſt be raviſhing. But, when gradually accuſtomed to muſic more compounded, the ear would diſcover new ſources of delight. The pleaſure of a ſucceſſion of muſical tones being ſuperior to that of a continued noiſe, he would not confound the one with the other.

3. *Smelling and Hearing united.*

As theſe ſenſes, taken ſeparately, give to our ſtatue no idea of external objects, neither can they by their union. He would never ſuſpect that he had two different organs of perception, nor, at firſt, diſtinguiſh two modes of exiſtence in himſelf. Sounds and odours would be confounded, and ſeem to be only one ſimple modification. He would learn, however, by experience, and the aid of memory, to diſtinguiſh two ſenſations; and then he would think that his exiſtence was double. His train of ideas is more varied and extenſive, becauſe he has two kinds of modification; and, perhaps, noiſe would ſeem ſo different from harmonious ſounds, that he might imagine he had three ſenſes.

4. *Taſte alone, and Taſte united with* Smelling *and Hearing.*

When limited to taſte alone, the ſtatue would acquire the ſame mental powers as with ſmelling or hearing. Taſte would contribute more to his happineſs and miſery than ſmelling or hearing; becauſe ſavours, in general, affect us more than ſmells, or even harmonious ſounds.

When taſte is united with ſmelling and hearing, the ſtatue, after learning to know them ſeparately, would be enabled to diſtinguiſh theſe ſenſations, even when tranſmitted to him at the ſame time; and therefore his exiſtence would in ſome meaſure be tripled. The union of theſe ſenſes would ſtill farther extend and diverſify the train of his ideas, augment the number of his deſires, and make him contract new habits.

5. *Of Sight alone.*

Sight and all ſenſations are internal, and belong to the mind. The difficulty is to conceive how we refer theſe ſenſations to external objects or cauſes. Our ſtatue would conſider light and colour as modes of his own exiſtence; but could have no idea that they belonged to bodies diſtinct from himſelf. At firſt he would not be able to diſtinguiſh one colour from another; but he would ſoon acquire the habit of conſidering one colour at a time, and thus learn to diſtinguiſh them. By ſight alone he could have no idea of figure, ſituation, extenſion, or motion.

6. *Sight united with Smell, Hearing, and Taſte.*

This union would augment our ſtatue's mode of exiſtence, extend the chain of his ideas, and multiply the objects of his attention, of his deſires, and of his enjoyments. But he would ſtill continue to perceive himſelf alone, and could have no idea of external objects. He would ſee, ſmell, taſte, and hear, without knowing that he had eyes, noſe, mouth, or ears, nor even that he had a body. With the ſame colour before his eyes, if a ſucceſſion of ſmells, ſavours, and ſounds, were preſented to him, he would conſider himſelf as a colour ſucceſſively odoriferous, ſavoury, and ſonorous. If the ſame odour were conſtantly preſent with him, he would conſider himſelf as a ſavoury, ſonorous, and coloured odour.

7. *Of Touching alone.*

The ſmalleſt degree of ſentiment, or feeling, which a man limited to the ſenſe of touching could have, would ariſe from the action of different parts of the body, and particularly from the motion of reſpiration. This the Abbé calls the *fundamental ſentiment*, becauſe with it life commences. As ſoon as this fundamental ſentiment has undergone any change, the ſtatue is conſcious of his own exiſtence. When not ſtruck by any external body, and placed in a temperate tranquil air, of an equal degree of heat, he would only recogniſe his exiſtence by the confuſed impreſſion reſulting from the motion of reſpiration. He cannot diſtinguiſh the different parts of his body, and conſequently has no idea of extenſion. Different feelings perceived at the ſame time convey a confuſed ſenſation only. But, when heat and cold are felt in ſucceſſion, he diſtinguiſhes them, and retains in his memory the idea of each ſenſation. Touching different parts of his body, and of external objects, gradually unfolds the ideas of extenſion, ſolidity, ſoftneſs, hardneſs, diſtance, &c. Hence he no longer confounds himſelf with his modifications. He is no longer heat or cold; but he perceives heat in one part and cold in another. By means of the hand, he diſtinguiſhes his own perſon from external objects. When he touches the parts of his body, each part returns a ſenſation. But, when he touches another body, he feels that it exiſts, but returns no ſenſation; and hence he learns that there are bodies which conſtitute no part of himſelf.

Children derive the greateſt happineſs from motion. Even falls do not deter them. A bandage on their eyes would give them leſs pain than a reſtraint on the uſe of their limbs. Motion, beſide many other advantages, gives them the moſt lively conſciouſneſs of their own exiſtence and powers. If exerciſe be pleaſant to children, it would be ſtill more ſo to our ſtatue; for as yet he not only knows no obſtacle to interrupt his movements, but he will ſoon experience all the pleaſures to be derived from motion. The ſtatue at firſt loves every body that does not hurt him. Poliſhed and ſmooth ſurfaces will be agreeable to him; and he will be delighted to find that he can at pleaſure enjoy warmth or coolneſs. He will receive peculiar pleaſure from objects, which, from their figure and magnitude, are moſt accommodated to the form of his hand. At other times, the difficulty of handling objects, on account of their ſize or weight, will give him pleaſure by ſurpriſe; and this pleaſure will be augmented by the ſpace he diſcovers around them, which will render the motion of his body from one place to another extremely agreeable. Solidity and fluidity, hardneſs and ſoftneſs, motion and reſt, will be pleaſant ſenſations; for the more he contraſts them, the more they will attract his attention and extend his ideas. But the habit he acquires of comparing and judging is the greateſt ſource of his pleaſures. He no longer touches objects ſolely for the pleaſure of handling them. He wiſhes to know their relations, and he feels as many agreeable ſenſations as he forms new ideas.

Touching expoſes him more frequently to pain than the other ſenſes. But pleaſure is always within his reach, and pain is felt only at intervals. His deſires conſiſt chiefly of the efforts of his mind to recal the moſt agreeable ideas. But that kind of deſire of which the ſenſe of touch renders him capable, includes motion, or the power of ſearching for ſenſations. Hence his enjoyments are not limited to the ideas preſented by the imagination, but extend to all the objects he can reach; and his deſires, inſtead of being concentrated into modes of his exiſtence, as in the other ſenſes, lead him always to external bodies, which are the objects of his love, hatred, and other paſſions.

By motion he acquires the idea of ſpace. Repeated experience of diſcovering new ſenſations renders him capable of curioſity. But pain repreſſes his deſire of moving, and makes him diffident. Hence he learns to move with caution; and the ſame chance that led him to lay hold of a ſtick, will teach him to uſe it for exploring what may be hurtful to him. Pleaſure and pain are the ſources of all his ideas, the number of which acquirable by our ſtatue is almoſt infinite. He learns to compare his different ſenſations, and to diſtinguiſh different bodies. He acquires the idea of figure, and becomes capable of reflection and abſtraction. He acquires likewiſe the ideas of number, of duration, of ſpace, and of immenſity.

8. *Of Touch united with Smelling.*

On this ſuppoſition, the ſtatue would perceive himſelf to be two different beings, one that he could touch, and another which he could not. When chance made him lay hold of an odorous body, he would find that its ſmell was ſtronger or weaker, in proportion as he brought the body nearer, or removed it farther from his face. This experiment frequently repeated will give him the idea that ſmell proceeds from, or is a quality of bodies. By the ſame means he diſcovers the organ of ſmelling. From this ſource his ideas concerning the qualities of bodies are greatly extended.

9. *Hearing, Taſte, and Touching, united.*

At firſt our ſtatue is totally occupied with this new ſenſe, and believes himſelf to be the ſinging of birds, the noiſe of a caſcade, &c. By the exerciſe, however, of handling ſonorous bodies, or of letting them fall, he perceives that ſound is produced by impulſe or colliſion, gradually diſcovers this new organ, and that noiſe is a property of bodies even at a diſtance.

10. *Of Sight united with all the other Senſes.*

The eye conveys no idea of diſtance, of magnitude, of figure, or of ſituation, without the aſſiſtance of touching. Either from chance, or from the pain occaſioned by too ſtrong a light, the ſtatue carries his hand to his eyes. The colours of objects inſtantly diſappear. He removes his hand, and the colours return. Hence he learns that colours are not modes of his exiſtence, but that they ſeem to be ſomething exiſting in his eyes, in the ſame manner as he feels at the ends of his fingers the objects he touches.

The Abbé, in the ſame ingenious manner, ſhews how, by experience and habit, by motion and touching, we acquire a facility in correcting the errors of viſion. But our limits permit us not to follow him any farther.

CHAPTER VII.

Of Infancy.

BY the term *Infancy*, in this chapter, is generally meant that portion of life which commences at birth, and terminates at that period when animals have acquired the power of ſelf-preſervation, without any aſſiſtance from their parents. This period varies greatly in different animals. Of courſe, when different ſpecies are mentioned, the term *infancy* muſt have very different limitations with regard to time.

The ſtate of infancy, in the human ſpecies, continues longer than in any other animal. Infants, immediately after birth, are indeed extremely helpleſs, and require every aſſiſtance and attention from the mother. Moſt writers, however, on this ſubject ſeem to have exaggerated not only the imbecillity, but the miſeries of the infant ſtate. 'An infant,' ſays Buffon, 'is *more helpleſs* than the young 'of any other animal: Its uncertain life ſeems every moment to vi'brate on the borders of death. It can neither move nor ſupport 'its body: It has hardly force enough to exiſt, and to announce, by 'groans, the pain which it ſuffers; as if Nature intended to appriſe 'the little innocent, that it is born to *miſery*, and that it is to be rank'ed among human creatures only to partake of their infirmities and 'of their afflictions *.'

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* Buffon, vol. 2. pag. 369. Tranſlat.

This humiliating picture is partly juſt, and partly miſrepreſented. Though infants remain longer in a ſtate of imbecillity than the young of other animals, they are by no means more *helpleſs*. The inſtant after birth, they are capable of ſucking whatever is preſented to their mouths. When in the ſame condition, the young of the opoſſum, of hares, rabbits, rats, mice, &c. can do no more. They can neither move nor ſupport their bodies. Beſides, many quadrupeds are deſtitute of the ſenſe of ſeeing for ſeveral days after birth. But the faculty of viſion is enjoyed by infants the moment after they come into the world. This faculty, in a few hours, becomes a great ſource of pleaſure and amuſement to them; but it is denied, for ſome days, to many other ſpecies of animals. The young of moſt birds are equally weak and helpleſs as human infants. The former have no other powers but thoſe of reſpiration, opening their mouths to receive food from the parent, and ejecting the excrement, after the food has been properly digeſted. If infants really ſuffer more pain and miſery than other animals in the ſame ſtate, Nature ſeems not to merit that ſeverity of cenſure which ſhe has ſometimes received. Man in ſociety, like domeſtic animals, by luxury, by artificial modes of living, by unnatural and vicious habits, debilitate their bodies, and tranſmit to their progeny the ſeeds of weakneſs and diſeaſe, the effects of which are not felt by thoſe who live more agreeably to the general oeconomy and intentions of Nature. The children of ſavages, for the ſame reaſon, whether in the hunting or ſhepherd ſtate, are more robuſt, more healthy, and liable to fewer diſeaſes, than thoſe produced by men in the more enlightened and refined ſtages of ſociety. Even under the ſame governments, and in the ſame ſtate of civilization, a ſimilar gradation of imbecillity and diſeaſe is to be obſerved. The children of men of rank and fortune are, in general, more puny, debilitated, and diſeaſed, than thoſe of the peaſant or artificer. Still, however, children, in their progreſs from birth to maturity, have innumerable ſources of pleaſure, which alleviate, if they do not fully compenſate, the pain which muſt unavoidably be endured, whether in a more natural or more artificial ſtate of mankind. If luxury and civilization debilitate the conſtitutions of children, they give riſe to many real enjoyments which are totally unknown to the ſavage. His wants are fewer; but his gratifications are more than proportionally diminiſhed.

Though the period of human infancy be proportionally long, it is too often increaſed by improper management. In this, and many other countries of Europe, infants have no ſooner eſcaped from the womb of their mothers, and have enjoyed the liberty of ſtretching their limbs, than they are again condemned to a more cruel and unnatural bondage. The head is fixed in one poſition; the legs are fettered; the arms are bound down to the ſides; and the little innocents are laced with bandages ſo ſtrait that they cannot move a ſingle joint. The reſtraint of ſwaddling bands muſt be productive of pain. Their original intention was to prevent the head and limbs from being diſtorted by unnatural or hurtful poſitions. But it was not conſidered, that the efforts made by infants to diſentangle themſelves, have a greater tendency to diſtort their members than any poſtures they could aſſume, if they enjoyed a greater degree of liberty. But, if the efforts for liberty made by infants fettered in this cruel manner be hurtful, the ſtate of inactivity in which they are forced to remain, is, perhaps, equally noxious. Infants, as well as all young animals, are extremely prone to motion. It promotes the growth and expanſion of their organs. It likewiſe invigorates all their members, and facilitates the circulation and ſecretion of their different fluids. But, when infants are deprived of exerciſe, or of the power of performing their natural movements, the oppoſite effects are produced. The want of exerciſe retards their growth and weakens their conſtitution. Thoſe children, therefore, who are allowed full freedom of motion will always be the moſt healthy and the moſt vigorous.

gorous. We are, however, happy to remark, that, by the efforts of philoſophers and phyſicians, the practice of employing tight bandages has of late become leſs general, eſpecially among intelligent midwives and mothers. But, to eradicate long eſtabliſhed prejudices, and to diffuſe more enlightened and ſalutary notions through a whole country, cannot be effected without a great length of time and vigorous exertions.

From what cauſes or circumſtances particular modes in the management of infants originate, it is difficult to determine. But it is certain that ſavages, and the ruder nations, in their treatment of infants, often diſcover more diſcernment, and propriety of conduct, than are to be found in the moſt poliſhed ſtages of ſociety. The negroes, the ſavages of Canada, of Virginia, of Braſil, and the natives of almoſt the whole of South America, inſtead of uſing ſwaddling-bands, lay their infants naked into hammocks, or hanging beds of cotton, or into cradles lined with fur. The Peruvians leave the arms of their infants perfectly looſe in a kind of ſwathing-bag. When a little older, they are put, up to the middle, in a hole dug out of the earth, and lined with linen or cotton. By this contrivance, their arms and head are perfectly free, and they can bend their bodies, and move their arms and head, without the ſmalleſt danger of falling, or of receiving any injury. To entice them to walk, whenever they are able to ſtep, the breaſt is preſented to them at a little diſtance. The children of negroes, when very young, cling round, with their knees and legs, one of their mother's haunches, and graſp the breaſt with their hands. In this poſition they adhere ſo firmly, that they ſupport themſelves without any aſſiſtance, and continue to ſuck without danger of falling, though the mother moves forward, or works at her uſual labour. Theſe children, at the end of the ſecond month, begin to creep on their hands and knees; and, in this ſituation, they acquire, by habit, the faculty of running with ſurpriſing quickneſs.

Savages are remarkably attentive to the cleanlineſs of their children. Though they cannot afford to change their furs ſo frequently as we do our linen, this defect they ſupply by other ſubſtances of no value. The ſavages of North America put wood-duſt, obtained from decayed trees, into the bottom of the cradle, and renew it as often as it is neceſſary. Upon this powder the children are laid, and covered with ſkins. This powder is very ſoft, and quickly abſorbs moiſture of every kind. The children in Virginia are placed naked upon a board covered with cotton, and furniſhed with a proper hole for tranſmitting the excrement. This practice is likewiſe almoſt general in the eaſtern parts of Europe, and particularly in Turkey. It has another advantage: It prevents the diſmal effects which too often proceed from the negligence of nurſes.

Many northern nations plunge their infants, immediately after birth, into cold water, without receiving any injury. The Laplanders expoſe their new-born infants on the ſnow till they are almoſt dead with cold, and then throw them into a warm bath. During the firſt year, this ſeemingly harſh treatment is repeated three times every day. After that period, the children are bathed in cold water thrice every week. It is a general opinion in northern regions, that cold bathing renders men more healthy and robuſt; and hence they inure their children, from their very birth, to this habit. In the iſthmus of America, the inhabitants, even when covered with ſweat, plunge themſelves with impunity into cold water. The mothers bathe in cold water, along with their infants, the moment after delivery; yet much fewer of them die of child-bearing, than in nations where a practice of this kind would be conſidered as extremely hazardous.

With regard to the food of infants, it ſhould conſiſt, for the firſt two months, of the mother's milk alone. A child may be injured by allowing it any other nouriſhment before the end of the firſt month. In Holland, in Italy, in Turkey, and over the whole Levant, children, during the firſt year, are not permitted to taſte any other food. The Canadian ſavages nurſe their children four or five years, and ſometimes ſix or ſeven. In caſes of neceſſity, the milk of quadrupeds may ſupply that of the mother. But, in ſuch caſes, the child ſhould be obliged to ſuck the animal's teat; for the degree of heat is always uniform and proper, and the milk, by the action of the muſcles, is mixed with the ſaliva, which is a great promoter of digeſtion. Several robuſt peaſants have been known to have had no other nurſes than ewes. After two or three months, children may be gradually accuſtomed to food ſomewhat more ſolid than milk. Before the teeth ſhoot through the gums, infants are incapable of maſtication. During that period, therefore, it is obvious that Nature intended they ſhould be nouriſhed ſolely by ſoft ſubſtances. But, after they are furniſhed with teeth, it is equally obvious, that they ſhould occaſionally be allowed food of a more ſolid texture.

The bodies of infants, though extremely delicate, are leſs affected by cold than at any other period of life. This effect may be produced by the ſuperior quickneſs in the pulſation of the heart and arteries which takes place in ſmall animals. The pulſe of an infant is more frequent than that of an adult. The pulſe of a horſe, or of an ox, is much ſlower than that of a man; and the motion of the heart, in very ſmall animals, as that of a linnet, is ſo rapid that it is impoſſible to count the ſtrokes.

The lives of children, during the firſt three or four years, are extremely precarious. After that period, their exiſtence becomes gradually more certain. According to Simpſon's tables of the degrees of mortality at different ages, it appears, that, of a certain number of infants brought forth at the ſame time, more than a fourth part of them died in the firſt year, more than a third in two years, and at leaſt one half at the end of the third year. Mr Simpſon made this experiment upon children born in London. But the mortality of children is not nearly ſo great in every place; for M. Dupré de S. Maur, by a number of experiments made in France, has ſhown, that one half of the children born at the ſame time are not extinct in leſs than ſeven or eight years.

To treat of the diſeaſes of children, or to enter minutely into the cauſes which contribute to the great mortality of mankind in early infancy, is no part of our plan. In general, theſe cauſes are to be referred to unnatural practices in the management of children, introduced by ſuperſtition, by ignorance, and by fooliſh notions ariſing from over-refinement, from prejudice, and from hypothetical ſyſtems, while the oeconomy and analogy of Nature, in the conduct and ſituation of the inferior animals, are almoſt totally neglected. Every animal, except the human ſpecies, brings forth its young without any foreign aid. But incredible numbers of children, as well as of mothers, are daily maimed, enfeebled, and deſtroyed, by the ignorance and barbarity of midwives and accoucheurs. An infant is no ſooner brought into the world than it is crammed with phyſic. Nature's medicine for cleanſing the bowels of infants is the milk of the mother. But midwives abſurdly imagine that drugs will anſwer this purpoſe much better. All other animals that give ſuck nurſe their own offspring: But we too frequently delegate this tender and endearing office to ſtrange women, whoſe conſtitutions, habits of life, and mental diſpoſitions, are often totally different from thoſe of the genuine parent. Infants, recently after birth, frequently ſuffer from giving them, inſtead of the mother's milk, wine-whey, water-gruel, and ſimilar unnatural kinds of nouriſhment. In this period of their exiſtence, however, very little food, but a great deal of reſt, is neceſſary for promoting their health, and ſecuring their eaſe and tranquillity; for infants, when not teazed by officious cares, ſleep almoſt continually during ſeveral weeks after birth. Young animals are naturally fond of being in the open air; but our infants, particularly in large towns, are almoſt perpetually ſhut up in warm apartments, which both relaxes their bodies and enervates their minds. The great agility, ſtrength, and fine proportions of ſavages, are reſults of a hardy education, of living much in the open air, and of an unreſtrained uſe of all their organs the moment after they come into the world.

In young animals, as well as in infants, there is a gradual progreſs, both in bodily and mental powers, from birth to maturity. Theſe powers are unfolded ſooner or later, according to the nature and exigencies of particular ſpecies. This progreſs, in man, is very ſlow. Man acquires not his full ſtature and ſtrength of body till ſeveral years after the age of puberty: And, with regard to his mind, his judgement and other faculties cannot be ſaid to be perfectly ripe before his thirtieth year.

In early infancy, though the impreſſions received from new objects muſt be ſtrong, the memory appears to be weak. Many cauſes may concur in producing this effect. In this period of our exiſtence, almoſt every object is new, and, of courſe, ingroſſes the whole attention. Hence the idea of any particular object is obliterated by the quick ſucceſſion and novelty of others, joined to the force with which they act upon the mind. Haller aſcribes this want of recollection to a weakneſs of memory; but it ſeems rather to proceed from a confuſion which neceſſarily reſults from the number and ſtrong impreſſions of new objects. The memory ripens not ſo much by a gradual increaſe in the ſtrength of that faculty, as by a diminution in the number and novelty of the objects which ſollicit attention. In a few years children are enabled to expreſs all their wants and deſires. The number of new objects daily diminiſhes, and the impreſſions made by thoſe with which they are familiar become comparatively ſmall and unintereſting. Hence their habits of attention, and the ardour of their minds, begin to relax. Inſtead of a general and undiſtinguiſhing gratification of their ſenſes, this is the period when it is neceſſary to ſtimulate children, by various artifices, to apply their minds ſteadily to the examination of particular objects, and to the acquiſition of new ideas from more complicated and refined ſources of information. The great baſis of education is a habit of attention. When this important point is gained, the minds of children may be molded into any form. But that reſtleſſneſs, and appetite for motion, which Nature, for the wiſeſt purpoſes, has implanted in the conſtitution of all young animals, ſhould not be too ſeverely checked. Health and vigour of body are the ſureſt foundations of ſtrength and improvement of mind.

With regard to the duration of infancy, from man to the inſect tribes, it ſeems, in general, to be proportioned, not to the extent of life, but to the ſagacity or mental powers of the different claſſes of animated beings. The elephant requires 30 years, and the rhinoceros 20, before they come to perfect maturity, and are enabled to multiply their ſpecies. But theſe years mark not the period of infancy; for the animals, in a much ſhorter time, are capable of procuring their own food, and are totally independent of any aid from their parents. The ſame remark is applicable to the camel, the horſe, the larger apes, &c. Their ages of puberty are four, two and a half, and three years. But, in theſe quadrupeds, the terminations of infancy are much more early. The ſmaller quadrupeds, as hares, rats, mice, &c. are mature at the end of the firſt year after birth; and the Guiney pig and rabbit require only five or ſix months. There is a gradation of mental powers, though not without exceptions, from the larger to the more minute quadrupeds; for the dog and fox, whoſe ſagacity is very great, come to maturity in one year, and their ſtate of infancy is ſhort. But, of all animals, the infancy and helpleſs condition of men are the moſt prolonged; and the ſuperiority and ductility of his mind will not be queſtioned.

The infant ſtate of birds is very ſhort. Moſt of the feathered tribes arrive at perfection in leſs than ſix months; and their ſagacity is comparatively limited.

With regard to fiſhes, if the whale and ſeal kind, who ſuckle their young, be excepted, they receive no aid from their parents. Fiſhes no ſooner eſcape from the eggs of their mother, than they are in a condition to procure nouriſhment, and to provide, in ſome meaſure, for their own ſafety. Of the ſagacity of fiſhes, owing to the element in which they live, we have very little knowledge. But their general character is ſtupidity, joined to a voracious and indiſcriminating appetite for food. In oppoſition to an almoſt general law of Nature which ſubſiſts among other animals, fiſhes devour, without diſtinction, every ſmaller or weaker animal, whether it belongs to a different ſpecies, or to their own. In animals of a much higher order, voracity of appetite is ſeldom accompanied with ingenuity or elegance of taſte. When the principal attention of an animal is engroſſed with any ſenſual appetite, it is a fair concluſion that the mental powers are weak, becauſe they are chiefly employed upon the groſſeſt of all objects. If this obſervation be juſt, fiſhes muſt be ranked among the moſt ſtupid animals of equal magnitude and activity.

The infant ſtate of inſects is a various and complicated ſubject. After they eſcape from the egg, they undergo ſo many changes, and aſſume ſuch a variety of forms, that it is difficult to determine the period of their exiſtence which correſponds to the condition of infancy in the larger animals. Different ſpecies remain longer or ſhorter in the form of worms, caterpillars, or grubs, before they are changed into chryſalids, and afterwards into flies. When young, like other animals, they are ſmall and feeble: But, even in their moſt helpleſs condition, with a very few exceptions, Nature is their only nurſe. They require no aid from their parents, who, in general, are totally unacquainted with their progeny. But, as formerly obſerved, when treating of inſtinct, the mothers uniformly depoſit their eggs in ſituations which afford both protection and nouriſhment to their young. The parent fly, according to the ſpecies, invariably, unleſs reſtrained by neceſſity, depoſits her eggs upon particular plants, in the bodies of other animals, in the earth, or in water. Whenever, therefore, an inſect receives exiſtence in its primary form, all its wants are ſupplied. Though the mother, after the worms iſſue from the eggs, takes no charge of her offspring, and frequently does not exiſt at the time they come forth, yet, by an unerring and pure inſtinct, ſhe uniformly places them in ſituations where the young find proper nouriſhment, and every thing neceſſary to their feeble condition.

To this general law, by which inſects are governed, there are ſeveral exceptions. Bees, and ſome other flies, not only conſtruct neſts for their young, but actually feed, and moſt anxiouſly protect them.

From what has been ſaid concerning the infancy of animals, one general remark merits attention. Nature has uniformly, though by various modes, provided for the nouriſhment and preſervation of all animated beings while they are in an infantine ſtate. Though the human ſpecies continues long in that ſtate, the attachment and ſollicitude of both parents, inſtead of abating, in proportion to the time and labour beſtowed on their progeny, conſtantly augment, and commonly remain during life. The reciprocal affection of parents and children is one of the greateſt ſources of human happineſs. If the love of children were not ſtrong, and if it did not increaſe with time, the labour, the conſtant attention, the anxiety and fatigue of mothers would be unſufferable. But here Nature, whoſe wiſdom is always conſpicuous, makes affection brave every difficulty, and ſooth every pain. If a child be ſickly, and require uncommon care, the exertions of the mother are wonderfully ſupported: Pity unites with love; and theſe two paſſions become ſo ſtrong, that hardſhips, and fatigue of every kind, are ſuffered with chearfulneſs and alacrity.

With regard to the inferior tribes of animals, Nature has not been leſs provident. To quadrupeds and birds ſhe has given a ſtrong and marked affection for their offspring, as long as parental care is neceſſary. But, whenever the young begin to be in a condition to protect and provide for themſelves, the attachment of the parents gradually ſubſides; they become regardleſs of their offspring, at laſt baniſh them with blows, from their preſence, and, after that period, ſeem to have no knowledge of the objects which ſo lately had engroſſed all the attention of their minds, and occupied all the induſtry and labour of their bodies.—Here the dignity and ſuperiority of man appears in a conſpicuous light. Inſtead of loſing the knowledge of his offſpring after they arrive at maturity, his affection expands, and embraces grandchildren, and great-grandchildren, with equal warmth as if they had immediately originated from himſelf.

CHAP.

CHAPTER VIII.

Of the Growth, and Food, of Animals.

IT is a law of Nature, that all organized bodies, whether animal or vegetable, require food, in order to expand and ſtrengthen their parts when young, and to preſerve health and vigour after they have arrived at maturity. The food of animals is digeſted in the ſtomach and inteſtines: By this proceſs it is converted into chyle, and abſorbed by the lacteal veſſels, in the manner deſcribed in Chap. II. pag. 48. But how this chyle, or nutritious matter, after mingling with the general maſs of blood, contributes to the growth, and repairs the waſte of animal bodies, is a myſtery which probably never will be unfolded by human ſagacity. It has, however, like many other ſecrets of Nature, given riſe to ſeveral ingenious theories and conjectures, ſome of which ſhall be ſlightly mentioned.

Buffon conſiders the bodies of animals and vegetables as what he calls *internal moulds*. He ſays, that the matter of nutrition is not applied by juxta-poſition, but that it penetrates the whole maſs; that each part receives and applies thoſe particles only which are peculiar and neceſſary to its own nature; and that, by this means, the whole parts of the body are gradually and proportionally augmented. This nutritive matter, he remarks, is organic, and ſimilar to the body itſelf; and hence the ſize of the body is increaſed, without any change in its figure or ſubſtance. The matter ejected by the different excretions he conſiders to be a ſeparation of the dead from the vivifying and organic parts of nouriſhment, which are diſtributed over the body by an active power: This power, ſimilar to that of gravity, penetrates the internal ſubſtance of the body, and attracts the organic particles, which are thus puſhed on through all its parts. As theſe organic particles are ſimilar to the body itſelf, their union with the different parts augments its ſize, without changing its figure. To unfold an embryo or germ, nothing more is requiſite than that it contain, in miniature, a body ſimilar to the ſpecies, and be placed in proper circumſtances for the acquiſition of freſh organic particles to increaſe its ſize and unfold its members. Hence nutrition, developement, and reproduction, are all effects of the ſame cauſe.

This account of the nutrition and growth of organic bodies has the appearance of an ingenious theory. But an attentive reader will eaſily perceive, that it contains no other information, than that animals and vegetables are nouriſhed and grow by the intervention of the nutritious particles of food. This is a fact univerſally known and admitted. But we are ſtill as ignorant as ever of the mode by which this myſterious operation is performed.

Other authors have ſuppoſed that the brain is a large gland; that the nerves diſtributed over the whole body are the ducts or canals of this gland; and that the principal uſe of the brain is to ſecrete nutritious matter, and to tranſmit it by the nerves to the various parts of the ſyſtem, in order to expand the different organs of which it is compoſed, or to repair the waſte they may have ſuffered from labour and other cauſes.

This theory preſuppoſes that the nerves are tubular, and contain a fluid: But both of theſe circumſtances have hitherto eluded the reſearch of the ableſt anatomiſts. Beſides, the learned and indefatigable Doctor Monro, in his *Nervous Syſtem*, has rendered it highly improbable that the nerves are the inſtruments of nutrition. The Doctor reaſons in the following manner. On comparing different animals, he remarks, we find no correſpondence between the ſize of their brain, the rapidity of their growth, or the quantity of nouriſhment they receive. An ox is ſix times heavier than a man; but the brain of an ox weighs not above a fourth part of that of a man. On this ſuppoſition, an ox's brain muſt ſecrete twenty-four times more nouriſhment than a portion equal to it of the human brain. In two years an ox acquires his full ſize. His brain muſt, of courſe, be ſuppoſed to tranſmit daily through the nerves two or three pounds of fleſh, bones, &c. But the much larger brain of a man does not, in an equal time, add to his body a fiftieth part of that weight.

'In monſters, ſays the Doctor, 'I have found the limbs very 'plump, though the brain was very ſmall. Nay, in ſome monſters, 'the head has been wanting, yet the limbs were as large and per'fect as common. In other monſters with one head and two bo'dies, I have found that the brain furniſhed the nerves of the head 'and ſpinal marrow on the right ſide of the monſter; yet the left 'ſpinal marrow, at the top of which there was only a ſmall medul'lary knob, about the ſize of a large pea, was as perfect as the right 'one; and that body, and its limbs, were as large, and as well nou'riſhed, as thoſe on the right ſide. On the other hand, where there 'were two heads of the ordinary ſize, and only one body, the limbs 'were not remarkable for their ſize.

'We ſee that organs, of which the nerves are ſo ſmall that we 'cannot trace them by diſſection, as the bones, the placenta, &c.

'grow as quickly as the other organs, in which the nerves are large 'and numerous.

'A year after I had cut acroſs the ſciatic nerve of a living frog, I 'could not perceive that limb ſmaller than the other; yet it conti- 'nued to be inſenſible and motionleſs. Nay, when I had broken 'the bones of the inſenſible limb, or wounded the ſkin and fleſh, I 'found that the callus formed, and the wounds healed, as readily as 'if the nerve had been entire. The event was the ſame after di- 'viding, tranſverſely, the lower or poſterior end of the ſpinal mar- 'row of the frog.

'It is well known,' concludes our author, 'that, if powder 'of madder root is mixed with the food of a young animal, the 'bones become red; or, if a bone has been broken, that the callus 'joining its parts will be red. The ſerum of the blood, in the firſt 'place, is deeply tinged; but the red colour of the bones is not ſole- 'ly, nor even chiefly, owing to the coloured ſerum or blood circu- 'lating; for I have found, that, after injecting water into the veſſels 'till theſe were emptied of the blood, and that the water came out 'colourleſs, the tinge in the bones appeared equally deep, and was, 'therefore, plainly owing to a great quantity of the red earth added 'to the bones in the time of their growth. But this earth was not 'tranſmitted by the nerves; for the colour of theſe, as I found, re- 'mained unchanged.'

That the nutritious particles of food are conveyed by the arteries, and applied by their extremities to the various parts of animal bodies which require to be repaired or expanded, is an opinion not only beſt ſupported by facts, but adopted by all the more rational phyſiologiſts. The principal facts and arguments in ſupport of this theory ſhall now be mentioned.

The chyle, as formerly remarked, is converted into blood. The glutinous part of the blood, known by the name of *coagulable lymph*, reſembles the white of an egg. That the white of an egg is the ſole nouriſhment of the chick before its excluſion, is an eſtabliſhed fact; and the concluſion, from analogy, that the lymph of blood is deſtined for the growth and reparation of animal bodies, is by no means unnatural. 'Without repeating,' ſays Dr Monro, 'our extreme 'uncertainty as to the tubular nature of the nerves, and the impro'bability that canals ſo exceedingly minute as thoſe within the 'nerves muſt be, and of ſuch length, are deſtined for the convey'ance of glue, do we not find, that this very matter is ſeparated by 'the exhalant branches of the arteries of the peritoneum, pleurae, 'and other ſhut ſacs, and univerſally, by the branches of the ar'teries of the cellular membrane?—The kinds of matter neceſſary 'for the growth and nouriſhment of our ſeveral organs are ſo vari'ous and different in their nature, that it is altogether incredible they 'can be furniſhed by the nerves: Thus, water is needed for the ex'tenſion of the fore-part of the eye, viſcid matter for the cryſtalline 'and vitreous humours, earth for the growth of the bones, &c.; 'whereas we can as eaſily conceive theſe to be furniſhed by the ar'teries, as that, in one place, they ſhould furniſh ſaliva, in another 'bile, &c.—As the waſte of the ſeveral organs is carried off by the 'veſſels, either circulating or abſorbent, why ſhould we doubt that 'the circulating fluids can add a particle in the place of one that has 'been carried off, or that an artery can ſupply what has been abſorb'ed by a lymphatic vein? As it is granted that the ſecretion of all 'other kinds of matter in the bodies of animals is performed by the 'branches of the arteries, is it not incredible that there ſhould be 'an exception to the general rule in the ſecretion of the nouriſh'ment? Surely that power which can convert the food into blood, 'and can change the blood into bile and ſaliva, is ſufficient to con'vert it into nouriſhment.

'I will now add,' continues our author, 'that in calli, cicatrices, 'or accretions, there are numberleſs new formed veſſels filled, in 'the living animal, with red blood, and which can readily be injec'ted. Nay, I found by experiment, that ſuch new formed veſſels, 'produced by the oppoſite ſides of a wound, unite into continued 'canals, or anaſtamoſe.—If, then, in a callus, new earthy or oſſeous 'fibres, and new veſſels, can be formed by the original arteries, muſt 'we not believe that the waſte of this earth, and of theſe veſſels, 'can be ever after ſupplied by the arteries which formed them? If 'ſo, are we not to conclude, that the waſte of other arteries, and of 'other organs, is ſupplied in the ſame manner from the arteries? If 'the quantity of blood naturally circulating through a limb be dimi'niſhed, as by tying the trunk of the brachial artery, in the opera'tion for an aneuriſm, the arm loſes part of its ſtrength and ſize; 'but the loſs is leſs than, at firſt ſight, might be expected; becauſe 'the anaſtomoſing (or uniting) canals ſoon come to be greatly en'larged.

'Upon the whole,' the Doctor concludes, 'there are few points 'in phyſiology ſo clear, as, 1. That the arteries prepare, and direct'ly ſecrete the nouriſhment in all our organs; and, 2. That the 'nerves do not contain nor conduct the nouriſhment, but, by 'enabling the arteries to act properly, contribute indirectly to nutri'tion.'

The ingenious Charles Bonnet endeavours to ſhow, that the parts of all organiſed bodies are contained, in miniature, in germs or buds; that theſe germs, when placed in proper ſituations, gradually unfold and increaſe in magnitude; that the various members of animals and vegetables are expanded, both longitudinally and laterally, by food adapted to their reſpective natures; and that every germ actually includes the rudiments of the whole animals or vegetables which are to proceed from it during all ſucceſſive generations.

With regard to vegetables, it is true, that the ſeed firſt produces a ſmall tree, which it contained in miniature within its lobes. At the top of this ſmall tree a bud or germ is formed, which contains the ſhoot or tree that is to ſpring next ſeaſon. In the ſame manner, the ſmall tree of the ſecond year produces a bud which includes a tree for the third year; and this proceſs uniformly goes on as long as the tree continues to vegetate. At the extremity of each branch, buds are likewiſe formed, which contain, in miniature, trees ſimilar to that of the firſt year. From theſe, and ſimilar facts, it is concluded, that all theſe germs were contained in the original ſeed; for the firſt bud was ſucceeded by a ſimilar bud, which was not unfolded till the ſecond year, and the third bud was not expanded till the third year; and, of courſe, the ſeed may be ſaid to have contained not only the whole buds which would be formed in a hundred years, but all the ſeeds, and all the individuals, which would ſucceſſively arrive till the final deſtruction of the ſpecies.

Theſe facts are known and eſtabliſhed; but the reaſoning deduced from them is fallacious, or, what amounts to the ſame thing, is perfectly incomprehenſible. The ſeed is unqueſtionably the origin or cauſe of all future individuals, which may be infinite. But the idea that it really contained the germs of all the individuals which were to ſpring from it as a ſource, is not only abſurd, but exceeds all the powers of human imagination to conceive. Theories of this kind, of which there are too many in almoſt every department of ſcience, hardly merit examination. Every ſeed, and every animal, according to this doctrine, includes in its own body an infinite poſterity! If we aſſent to reaſonings of this kind, we muſt loſe ourſelves in the labyrinths of infinity; and, inſtead of throwing light upon the ſubject, we ſhall involve it in tenfold darkneſs. All we know concerning the nature of growth and nutrition is extremely limited. We know that, in the animal kingdom, nutrition is performed by means of the blood, which is forcibly propelled through every part of the body by the action of the heart and arteries; and that vegetables, in a ſimilar manner, are nouriſhed by the aſcenſion and diſtribution of the ſap. But, how the nutritive particles are applied to the various parts of organized bodies, and how they expand the organs, or repair their continual waſte and loſs of ſubſtance, we muſt content ourſelves with remaining in perpetual ignorance.

In general, the food of animals, and particularly of the human ſpecies, conſiſts of animal and vegetable ſubſtances, combined with water or other fluids. The Gentoo, and ſome other ſouthern nations, live entirely upon vegetable diet. From the accounts we have of the different regions of the earth, it appears, that the natives of warm climates, where the cultivation of plants is practiſed, employ a greater proportion of vegetable food than in the more northern countries. The inhabitants of Lapland have little or no dependence on the fruits of the earth. They neither ſow nor reap. They ſtill remain, and, from the nature of their climate, muſt forever remain, in the ſhepherd ſtate. Their comparative riches conſiſt entirely of the number of rein-deer poſſeſſed by individuals. Their principal nouriſhment is derived from the fleſh and milk of theſe animals. In autumn, however, they catch great multitudes of fowls, moſt of them of the game kind. With theſe, while freſh, they not only ſupply their preſent wants, but dry and preſerve them through the winter. They likewiſe kill hares, and other animals, which abound in the woods and mountains; but the fleſh of the bear is their greateſt delicacy. In their lakes and rivers, they have inexhauſtible ſtores of fiſhes, which, in ſummer and autumn, they dry in the ſun, or in ſtoves, and in winter they are preſerved by the froſt. The Laplanders drink water, or animal oils; but never taſte bread or ſalt. They live in a pure air, and have ſufficient exerciſe. Their conſtitutions are attempered to the coldneſs of the climate; and they are remarkable for vigour and longevity. The gout, the ſtone, the rheumatiſm, and many other diſeaſes which torture the luxurious in milder climes, are totally unknown to them. With the few gifts which Nature has beſtowed on them, they remain ſatisfied, and live happily among their mountains and their ſtorms. If ſouthern nations afford examples of people who feed nearly on vegetables alone, the Laplanders furniſh one of the oppoſite extreme; for they are almoſt entirely carnivorous animals.

To Norway, Sweden, Germany, and Britain, the ſame obſervation is applicable. In theſe countries, animal food is much more uſed than in France, Spain, Italy, Barbary, and the other ſouthern regions of the globe. Many reaſons may be aſſigned for theſe differences in the food of nations. The natural productions of the earth depend entirely on the climate. In warm climates, the vegetables which grow ſpontaneouſly are both more luxuriant and more various. The number and richneſs of their fruits far exceed thoſe of colder regions. From this circumſtance, the natives muſt be ſtimulated to uſe a proportionally greater quantity of vegetable food; and we learn from hiſtory, and from travellers, that this is actually the caſe. In cold countries, on the contrary, vegetables are not only fewer, but more rigid, and contain leſs nouriſhment. The inhabitants, accordingly, are obliged to live principally on animal ſubſtances. If we examine the mode of feeding in different nations, it will be found, that, in proportion as men approach or recede from the poles, a greater or leſs quantity of animal and vegetable ſubſtances are uſed in their diet. Cuſtom, laws, and religious rites, it muſt be allowed, produce conſiderable differences in the articles of food, among particular nations, which have no dependence on climate, or the natural productions of the earth. But when men are not fettered or prejudiſed by extraneous circumſtances, or political inſtitutions, the nature of their food is invariably determined by the climates they inhabit. The variety of food, in any country, is likewiſe greatly influenced by culture, and by imitation. Commerce occaſionally furniſhes new ſpecies of food, particularly of the vegetable kind. In Scotland, till about the beginning of this century, the common people lived almoſt entirely upon grain. Since that period, the culture and uſe of the potatoe, of many ſpecies of coleworts, and of fruits, have been introduced, and univerſally diffuſed through the nation.

Whether man was originally intended by Nature to live ſolely upon animal or vegetable food ? is a queſtion which has been much agitated both by the ancients and the moderns. Many facts and circumſtances concur in eſtabliſhing the opinion, that man was deſigned to be nouriſhed neither by animals nor vegetables ſolely, but by a mixture of both. Agriculture is an art, the invention of which muſt depend on a number of fortuitous circumſtances. It requires a long ſucceſſion of ages before ſavage nations learn this art. They depend entirely for their ſubſiſtence upon hunting wild animals, fiſhing, and ſuch fruits as their country happens ſpontaneouſly to produce. This has uniformly been the manner of living among all the ſavage nations of which we have any proper knowledge ; and ſeems to be a clear proof, that animal food is by no means repugnant to the nature of man. Beſides, the ſurface of the earth, even in the moſt luxuriant climates, and though aſſiſted by culture, is not capable of producing vegetable food in ſufficient quantity to ſupport the human race, after any region of it has become ſo populous as Britain, France, and many other nations. The general practice of mankind, when not reſtrained by prejudice or ſuperſtition, of feeding promiſcuouſly on animal and vegetable ſubſtances, is a ſtrong indication that man is, partly at leaſt, a carnivorous animal. The Gentoos, though their chief diet be vegetables, afford no proper argument againſt this reaſoning. They are obliged, by their religion, to abſtain from the fleſh of animals; and they are allowed to uſe milk, which is a very nouriſhing animal food. Notwithſtanding this indulgence, the Gentoos, in general, are a meagre, ſickly, and feeble race. In hot climates, however, a very great proportion of vegetable diet may be uſed without any bad conſequences.

Other arguments, tending to the ſame concluſion, are derived, not from the cuſtoms or practices of particular nations, but from the ſtructure of the human body. All animals which feed upon vegetables alone, as formerly remarked, have ſtomachs and inteſtines proportionally larger than thoſe that live ſolely on animal ſubſtances. Man, like the carnivorous tribes, is furniſhed with cutting and canine teeth, and, like the graminivorous, with a double row of grinders. The dimenſions of his ſtomach and inteſtines likewiſe hold a mean proportion between theſe two tribes of animals, which differ ſo eſſentially in their characters and manners.—From theſe, and ſimilar arguments, I have no heſitation to conclude, that a promiſcuous uſe of animal and vegetable ſubſtances is no deviation from the original nature or deſtination of mankind, whatever country they may inhabit.

With regard to the different proportions of animal and vegetable food which are moſt accommodated to the health and vigour of mankind, no general rule can be given that could be applicable to different climates, and to the different conſtitutions of individuals. Animal food, it is certain, gives vigour to the body, and may be uſed more liberally by the active and laborious than by thoſe who lead a ſtudious and ſedentary life. A great proportion of vegetable food, and particularly of bread, is conſidered, by the moſt eminent phyſicians, as beſt adapted for men who are fond of ſcience and literature; for full meals of animal food load the ſtomach, and ſeldom fail to produce dulneſs, yawning, indolence, and many diſeaſes which often prove fatal.

The remainder of this chapter, from unavoidable cauſes, muſt conſiſt of obſervations of a more deſultory kind.

Moſt animals, when they live long on a particular ſpecies of food, are apt to be affected with diſeaſes, which generally ariſe from coſtiveneſs, or its oppoſite. The guiney-pigs, after being confined for ſome time to coleworts, contract a looſeneſs, which often terminates in death. But, when thoſe animals are at full liberty, they prevent this effect, by an inſtinct which teaches them to make frequent changes from moiſt to dry food: If they are reſtrained in their choice, they will eat, as a ſuccedaneum, paper, linen, and even woollen cloths.

Though ſome animals, and many vegetables, would be noxious to man, if uſed as food, yet, in general, that matter is more regulated by chance and cuſtom than by rational motives. By experience, and the aid of our ſenſes, we acquire a tollerable facility of diſtinguiſhing ſalutary from noxious food. Other animals ſelect their food inſtinctively; and their choice is chiefly determined by the ſenſe of ſmelling. The ſpaniel hunts his prey by the ſcent; but the grey-hound depends principally upon the uſe of his eye. When the grey-hound loſes ſight of a hare, he inſtantly gives up the chace, and looks keenly around him, but never applies his noſe, in order to diſcover the track. Some rapacious animals, as wolves and ravens, diſcover carrion at diſtances, which, if we were to judge from our own ſenſe of ſmelling, would appear to be altogether incredible. Others, as eagles, hawks, gulls, &c. ſurpriſe us no leſs by the acuteneſs of their ſight. They perceive, from great heights in the air, mice, ſmall birds, and minute fiſhes in the water.

One great cauſe of the diffuſion of animals over every part of the globe, is to be derived from the diverſity of appetites for particular ſpecies of food, implanted by Nature in the different tribes. Some fiſhes are only to be found in certain latitudes. Some animals inhabit the frigid, others the torrid zones; ſome frequent deſerts, mountains, woods, lakes, and meadows. In their choice of ſituation, they are uniformly determined to occupy ſuch places as furniſh them with food accommodated to their natures. Monkies, the elephant, and rhinoceros, fix on the torrid zone, becauſe they feed on vegetables which flouriſh there during the whole year. The rein-deer inhabit the cold regions of the north, becauſe theſe countries produce the greateſt quantity of the lichen, a ſpecies of moſs, which is their beloved food. The pelican makes choice of dry and deſert places to lay her eggs. When her young are hatched, ſhe is obliged to bring water to them from great diſtances. To enable her to perform this neceſſary office, Nature has provided her with a large ſac, which extends from the tip of the under mandible of her bill to the throat, and holds as much water as will ſupply her brood for ſeveral days. This water ſhe pours into the neſt to cool her young, to allay their thirſt, and to teach them to ſwim. Lions, tigers, and other rapacious animals, reſort to theſe neſts, drink the water, and are ſaid not to injure the young *. The goat aſcends the rocky precipice, to crop the leaves of ſhrubs, and other favourite plants. The ſloth and the ſquirrel feed upon the leaves and the fruit of trees,

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* Amoen. Acad. vol. 2. p. 41.

trees, and are, therefore, furniſhed with feet which enable them to climb. Water-fowls live upon fiſhes, inſects, and the eggs of fiſhes. Their bill, neck, wings, legs, and whole ſtructure, are nicely fitted for enabling them to catch the food adapted to their natures. Their feeding upon the eggs of fiſhes accounts for that variety of fiſhes which are often found in lakes and pools on the tops of hills, and on high grounds remote from the ſea and from rivers. The bat and the goat-ſucker fly about during the night, when the whole air is filled with moths, and other nocturnal inſects. The bear, who acquires a prodigious quantity of fat during the ſummer, retires to his den, when proviſions fail him, in winter. For ſome months, he receives his ſole nouriſhment from the abſorption of the fat which had been previouſly accumulated in the cellular membrane.

A glutton, brought from Siberia to Dreſden, eat every day, ſays M. Klein, thirty pounds of fleſh without being ſatisfied. This fact indicates an amazing digeſtive power in ſo ſmall a quadruped; for the ſtory of his ſqueezing his ſides between two trees, in order to make him diſgorge, is a mere fable *.

Siberia, Kamtſchatka, and the polar regions, are ſuppoſed to be the abodes of miſery and deſolation. They are, it muſt be allowed, infeſted with numerous tribes of bears, foxes, gluttons, and other rapacious animals. But it ſhould be conſidered, that theſe voracious animals ſupply the natives with both food and clothing. To elude the attacks of ferocity, and to acquire poſſeſſion of the ſkins and carcaſſes of ſuch creatures, the induſtry and dexterity of ſavage nations are excited. The furs are demanded by foreigners. The inhabitants by this means learn commerce and the arts of life; and, in the progreſs of time, bears and wild beaſts become the inſtruments of poliſhing

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* Gaz. Litteraire, vol. I. p. 481.

poliſhing a barbarous people. Thus, the moſt ſubſtantial good often proceeds from apparent misfortune.

There is hardly a plant that is not rejected as food by ſome animals, and ardently deſired by others. The horſe yields the common water-hemlock to the goat, and the cow the long-leafed water-hemlock to the ſheep. The goat, again, leaves the aconite, or bane-berries, to the horſe, &c. Plants which afford proper nouriſhment to ſome animals, are by others avoided, becauſe they would not only be hurtful, but even poiſonous. Hence no plant is abſolutely deleterious to animal life. Poiſon is only a relative term. The euphorbia, or ſpurge, ſo noxious to man, is greedily devoured by ſome of the inſect tribes.

It is a maxim univerſally received, that every animal, after birth, grows, or acquires an augmentation of ſize. The ſpider-fly, however, affords an exception. The mother lays an egg ſo diſproportionally large, that no perſon, without the aid of experience, could believe it to have been produced by this inſect. When the egg is hatched, a fly proceeds from it, which, at the moment of birth, equals the parent in magnitude. Upon a ſtricter examination of this egg, it has been diſcovered, that the inſect, while in the belly of its mother, undergoes a transformation into the nymph or chryſalis ſtate; and that, inſtead of a worm, a fly is produced from it, of the ſame dimenſions as the parent. This diſcovery, however, does not diminiſh our wonder, that any animal ſhould actually give birth to a ſubſtance as large as its own body, and that its ſize ſhould never afterwards receive any augmentation *.

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* Reaumur, tom. 6. p. 48.;—and Bonnet, tom. 3. p. 363.—369.

When caterpillars, ſome time before their change, are deprived of food, they diminiſh to at leaſt one half of their former ſize. Their chryſalids, of courſe, as well as the butterflies which proceed from them, are proportionally ſmall. From this fact we learn the importance of feeding all young animals well till they acquire their full growth.

It is a remark of the ingenious Reaumur, that ſuch inſects as feed upon dead carcaſſes, and whoſe fecundity is great, never attack live animals. The fleſh-fly depoſits her eggs in the bodies of dead animals, where her progeny receive that nouriſhment which is beſt ſuited to their conſtitution. But this fly never attempts to lay her eggs in the fleſh of ſound and living animals. If Nature had determined her to obſerve the oppoſite conduct, men, quadrupeds, and birds, would have been dreadfully afflicted by the ravages of this ſingle inſect. Leſt it might be imagined that the fleſh-fly ſelected dead, inſtead of live animals, becauſe, in depoſiting her eggs, ſhe was unable to pierce the ſkin of the latter, M. de Reaumur made the following experiment, which removed every doubt that might ariſe on the ſubject. He carefully pulled of all the feathers from the thigh of a young pigeon, and applied to it a thin ſlice of beef, in which there were hundreds of maggots. The portion of beef was not ſufficient to maintain them above a few hours. He fixed it to the thigh by a bit of gauze; and he prevented the pigeon from moving, by tying its wings and leggs. The maggots ſoon ſhewed that their preſent ſituation was diſagreeable to them. Moſt of them retired from under the ſlice of beef; and the few that remained periſhed in a ſhort time. Their death was probably occaſioned by the degree of heat in the pigeon's body being greater than their conſtitution could bear. Upon the ſame pigeon M. de Reaumur performed another experiment. He took off the ſkin from its thigh, laid bare the fleſh, and applied immediately another ſlice of beef full of maggots. The animals diſcovered evident marks of uneaſineſs; and all of them that remained on the fleſh of the pigeon were deprived of life, as in the former experiment, in leſs than an hour. Thus the degree of heat that is neceſſary to ſuch worms as inhabit the interior parts of animals, is deſtructive to thoſe ſpecies which Nature has deſtined to feed upon the fleſh of dead animals. Hence the worms ſometimes found in ulcerous ſores, muſt belong to a different ſpecies from thoſe upon which the above experiments were made.

The growth of ſome worms, which feed upon animal or vegetable ſubſtances, is extremely rapid. Redi remarked, that theſe creatures, the day after they eſcaped from the egg, had acquired at leaſt double their former ſize. At this period he weighed them, and found that each worm weighed ſeven grains; but that, on the day preceding, it required from twenty-five to thirty of them to weigh a ſingle grain. Hence, in about the ſpace of twenty-four hours, each of theſe worms had become from 155 to 210 times heavier than formerly. This rapidity of growth is remarkable in thoſe maggots which are produced from the eggs of the common fleſh-fly.

Before we diſmiſs this ſubject, a few obſervations on that power, inherent in all animal bodies, of diſſolving, and converting into chyle, every nutritive ſubſtance thrown into the ſtomach, merit attention.

In order to explain the proceſs of digeſtion, ſome phyſicians and philoſophers have had recourſe to mechanical force, and others to chemical action. The ſupporters of mechanical force maintained, that the ſtomachs of all animals comminuted, or broke down into ſmall portions, every ſpecies of food, and prepared it for being converted into chyle. The chemical philoſophers, on the contrary, ſupported the opinion, that the food was diſſolved by a fermentation induced by the ſaliva and gaſtric juices. The diſputes which naturally aroſe from theſe ſeemingly oppoſite theories, ſtimulated the inquiries of the ingenious, and produced ſeveral curious and important diſcoveries. Reaumur, M'Bride, Stevens, Spalanzani, Hunter, have all exerted their induſtry and talents upon this ſubject. To give even an abridged view of their different labours would be both tedious, and, at the ſame time, would not coincide with the deſign of this work. I ſhall therefore confine myſelf to ſome reſults of their experience and labours. Spalanzani, who is a voluminous writer on this ſubject, relates not only the diſcoveries of his predeceſſors, but has enriched his work with numerous experiments and obſervations made by himſelf. In his inveſtigation of the proceſs of digeſtion, and the action of the ſtomach, he obſerves the following order:

1. He treats of animals with ſtrong muſcular ſtomachs, as common fowls, turkeys, ducks, geeſe, pigeons, &c. 2. Of animals with ſtomachs of an intermediate conſiſtence, as crows, herons, &c. 3. Of animals with membranous ſtomachs, as frogs, lizards, earth and water ſnakes, vipers, fiſhes, ſheep, the ox, the horſe, the owl, the falcon, the eagle, the cat, the dog, man, &c.

With regard to birds which are furniſhed with muſcular ſtomachs, or gizzards, Spalanzani, in imitation of Reaumur, procured ſmall glaſs and metal balls and tubes, perforated with many holes. Theſe he filled with different kinds of food, and forced them down the throats of common fowls, turkeys, &c. He filled balls with barley, or other grains, in their entire ſtate, and allowed them to remain in the ſtomachs of ducks, turkeys, and other fowls, for twenty-four, and, in ſome caſes, for forty-eight hours. He then killed the animals, took the balls out of their ſtomachs, and, after examining the grains attentively, he could not diſcover that the gaſtric juice, to the action of which they were fully expoſed by the numerous holes in the balls, had made the ſmalleſt impreſſion upon them. They ſuffered no diminution of ſize, and exhibited no marks of diſſolution. Theſe experiments he often repeated upon a number of fowls provided with muſcular ſtomachs, and the event was uniformly the ſame: In no inſtance did the gaſtric juice produce any ſolvent effect upon the grain contained in the balls. After theſe unſucceſsful attempts, he ſuſpected, that, though the gaſtric juice was unable to diſſolve grains in their entire ſtate, it might act as a menſtruum upon them when ſufficiently maſticated or bruiſed. To aſcertain this point, he afterwards filled his balls with bruiſed grains, and introduced them into the ſtomachs of different fowls, as cocks, ducks, turkeys, wood-pigeons, &c. In all the numerous trials he made with bruiſed grain, he invariably found, that the grain was more or leſs diſſolved in proportion to the time the balls were allowed to remain in the ſtomach.

Reaumur and Spalanzani, in the courſe of their experiments upon the digeſtion of birds with muſcular ſtomachs, diſcovered a wonderful comminuting force which theſe ſtomachs poſſeſs. When tin tubes full of grain were thrown into the ſtomachs of turkeys, and allowed to continue there a conſiderable time, they were found to be broken, cruſhed, or diſtorted, in a moſt ſingular manner. 'Having found,' ſays Spalanzani, 'that the tin tubes which I uſed for 'common fowls were incapable of reſiſting the ſtomach of turkeys, 'and not happening at that time to be provided with any tin plate 'of greater thickneſs, I tried to ſtrengthen them, by ſoldering to the 'ends two circular plates of the ſame metal, perforated only with a 'few holes for the admiſſion of the gaſtric fluid. But this contri'vance was ineffectual; for, after the tubes had been twenty hours 'in the ſtomach of a turkey, the circular plates were driven in, 'and ſome of the tubes were broken, ſome compreſſed, and ſome 'diſtorted, in the moſt irregular manner *.'

The ſmooth and blunt ſubſtances formerly employed, Spalanzani remarks, though ſo violently acted upon, could not injure the ſtomach; he therefore tried what effects would be produced by ſharp bodies thrown into the gizzards of fowls. He found that the ſtomach of a cock, in the ſpace of twenty-four hours, broke off the angles of a piece of rough jagged glaſs. Upon examining the gizzard, no wound or laceration appeared. 'Twelve ſtrong tin needles,' ſays Spalanzani, 'were firmly fixed in a ball of lead, the points 'projecting about a quarter of an inch from the ſurface. Thus 'armed, it was covered with a caſe of paper, and forced down the 'throat of a turkey. The bird retained it for a day and a half 'without ſhowing the leaſt ſymptom of uneaſineſs. Why the ſto-'mach ſhould have received no injury from ſo horrid an inſtrument 'I cannot explain: The points of the twelve needles were broken 'off cloſe to the ſurface of the ball, except two or three, of which 'the ſtumps projected a little higher.—Two of the points of the 'needles were found among the food; the other ten I could not 'diſcover, either in the ſtomach or the long track of the inteſtines; 'and therefore concluded, that they had paſſed out at the vent †.'

The ſame author made a ſecond experiment ſeemingly ſtill more cruel. He fixed twelve ſmall lancets, very ſharp both at the points and edges, in a ſimilar ball of lead. 'The lancets,' ſays he, 'were 'ſuch as I uſe for the diſſection of ſmall animals. The ball was 'given to a turkey cock, and left eight hours in the ſtomach; at 'the expiration of which time that organ was opened; but no-'thing appeared except the naked ball, the twelve lancets having

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* Spalanzani's Diſſertations, vol. 1. p. 12.

† Ibid. p. 18.

‘ been broken to pieces. I diſcovered three of them in the large ‘ inteſtines, pointleſs, and mixed with the excrements; the other ‘ nine were miſſing, and had probably been voided at the vent. ‘ The ſtomach was as ſound and entire as that which had received ‘ the needles. Two capons, of which one was ſubjected to the experiment with the needles, and the other with the lancets, ſuſtained them equally well.’

The ſmall ſtones ſo commonly found in the ſtomachs of many of the feathered tribes, have been ſuppoſed to ſheath the gizzard, and to enable it to digeſt, or at leaſt to break down into ſmall fragments, glaſs, iron, wood, ſtones, and other hard, and even ſharp-pointed, ſubſtances. Spalanzani has endeavoured to prove, that the muſcular action of the gizzard is equally powerful, whether the ſmall ſtones are preſent or abſent. To aſcertain this point, he took wood-pigeons the moment they eſcaped from the egg, fed and nurſed them himſelf till they were able to peck: ‘ They were then,’ continues our author, ‘ confined in a cage, and ſupplied at firſt with ‘ vetches ſoaked in warm water, and afterwards in a dry and hard ‘ ſtate. In a month after they had begun to peck, hard bodies, ‘ ſuch as tin tubes, glaſs globules, and fragments of broken glaſs, ‘ were introduced with the food. Care was taken that each pigeon ‘ ſhould ſwallow only one of theſe ſubſtances. In two days after‘ wards they were killed. Not one of the ſtomachs contained a ‘ ſingle pebble; and yet the tubes were bruiſed and flattened, and ‘ the ſpherules and bits of glaſs blunted and broken: This happened ‘ alike to each body; nor did the ſmalleſt laceration appear on the ‘ coats of the ſtomach.’ From ſeveral experiments of a ſimilar nature, and accompanied with the ſame events, Spalanzani concludes this ſubject with that candour which is always a genuine characteriſtic of a real philoſophic ſpirit. Upon the whole, ‘ it appears,’ ſays he, ‘ that theſe ſmall ſtones are not at all neceſſary to the tritura 'tion of the firmeſt food, or the hardeſt foreign ſubſtance, contrary 'to the opinion of many anatomiſts and phyſiologiſts, as well an'cient as modern. I will not, however, deny, that, when put in 'motion by the gaſtric muſcles, they are capable of producing ſome 'effect on the contents of the ſtomach.'

The celebrated Mr John Hunter, in his *Obſervations on Digeſtion**, fairly quotes the modeſt concluſion of Spalanzani. But he inſiſts that ſtones are extremely uſeful in the comminution of grain, and other ſubſtances, which conſtitute the food of many fowls. 'In 'conſidering,' Mr Hunter remarks, 'the ſtrength of the gizzard, 'and its probable effects when compared with the human ſtomach, 'it muſt appear that the gizzard is, in itſelf, very fit for trituration. 'We are not, however, to conclude, that ſtones are entirely uſeleſs; 'for, if we compare the ſtrength of the muſcles of the jaws of ani'mals who maſtigate their food, with thoſe of birds who do not, 'we ſhall ſay, that the parts are well calculated for the purpoſe of 'maſtication; yet we are not from thence to infer, that the *teeth* 'in ſuch jaws are uſeleſs, even although we have proof that the '*gums* do the buſineſs when the teeth are gone. If ſtones are of 'uſe, which we may reaſonably conclude they are, birds have an 'advantage over animals having teeth, ſo far as ſtones are *always* 'to be found, while the teeth are not renewed.—If we conſtantly 'find in an organ ſubſtances which can only be ſubſervient to the 'functions of that organ, ſhould we deny them that uſe, although 'the part can do its office without them?—The ſtones aſſiſt in 'grinding down the grain, and, by ſeparating its parts, allow the 'gaſtric juice to come more readily in contact with it.'

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* Page 156.

The next ſeries of experiments were made upon animals with what Spalanzani denominates intermediate ſtomachs between the muſcular and membranous, as ravens, crows, herons, &c. The power and action of theſe intermediate ſtomachs are ſuperior to thoſe of the membranous kind, but greatly inferior to thoſe of the muſcular. The tin tubes, or balls, which pigeons and turkeys ſoon flatten and disfigure, remain unaltered in the ſtomach of crows. Their gaſtric muſcles, however, are by no means inert. Though they are unable to compreſs or diſtort tin tubes, they are capable of producing this effect upon thin tubes of lead. Birds whoſe ſtomachs are of an intermediate kind, with regard to the thickneſs and ſtrength of their muſcular coats, may be denominated *omnivorous*. They eat graſs, herbs, grain, and fleſh of every kind. When we make experiments, upon the digeſtive powers of gallinaceous birds, the animals muſt be killed before we can learn what effects have been produced on the ſubſtances incloſed in the balls or tubes. But, on crows and ravens, experiments of this kind may be repeated as often as we pleaſe, without deſtroying a ſingle individual. Subſtances which they are incapable of digeſting, as metallic tubes, they have the power of diſgorging, or returning by the mouth, in the ſame manner as falcons, and other birds of prey, throw up the feathers and hair of the animals they have devoured. In birds of prey, this vomiting is commonly performed every twenty-four hours; but, in crows, it happens at leaſt every nine, and not unfrequently every two or three hours.

Spalanzani, as in the former experiments, thruſt down perforated tubes, filled with different ſubſtances, into the ſtomachs of crows. Theſe tubes were uniformly thrown up by the animals in a few hours. When the tubes were filled with entire grains, as wheat or beans, he found that the gaſtric juice, though the tubes, by being repeatedly forced down, continued in the ſtomach for the ſpace of forty-eight hours, had exerted no ſolvent power. As the huſks of the ſeeds reſiſted the action of the gaſtric juice, he bruiſed them, and repeated the experiment. 'Four tubes full of this coarſe flour,' ſays he, 'were given to a crow: They remained eight hours in the 'ſtomach, and proved the juſtneſs of my ſuſpicion; for, upon ex'amining the contents, I found above a fourth part wanting. This 'could ariſe from no other cauſe but ſolution in the gaſtric liquor, 'with which the remainder was fully impregnated. Another ob'ſervation concurred in proving the ſame propoſition: The largeſt 'bits of wheat and bean were evidently much diminiſhed: This 'muſt have been owing to the gaſtric liquor having corroded and 'diſſolved good part of them, as the nitrous acid, diluted with a 'large quantity of water, gradually conſumes calcareous ſubſtances. 'I replaced what remained of the ſeeds in the tubes, and committed 'them again to the ſtomach, wherein they remained, at different 'intervals, twenty-one hours; at the end of which period they 'were entirely diſſolved; nothing being left but ſome pieces of huſk, 'and a few inconſiderable fragments of the ſeeds. Wheat and beans 'floating looſe in the cavity of the ſtomach, undergo the ſame alte'ration as in the tubes. When I fed my crows with theſe ſeeds, I 'obſerved, that, before they ſwallowed them, they ſet them under 'their feet, and reduced them to pieces by repeated ſtrokes of their 'long and heavy beaks: And now they digeſted them very well; 'nay, this proceſs was very rapid in compariſon of that which took 'place within the tubes. But, when the birds, either from exceſ'ſive hunger, or violence, ſwallowed the ſeeds entire, the greateſt 'part of them paſſed out entire at the anus, or were vomited. We 'cannot, therefore, be ſurpriſed, that the gaſtric juice could not diſ'ſolve them within the tubes, ſince it was incapable of effecting 'this proceſs within the cavity of the ſtomach, where its ſolvent 'power is far ſuperior.'

Similar experiments were made with French beans, peaſe, nut-kernels, bread, apples, and different kinds of fleſh and fiſh, all of which were diſſolved, both in tubes, and in the cavity of the ſtomach, by the gaſtric juice.

Spalanzani finiſhes his experiments on digeſtion with thoſe animals which have thin membranous ſtomachs. This claſs comprehends an immenſe number of ſpecies, as man, quadrupeds, fiſhes, reptiles. In theſe the coats of the ſtomach ſeem to have little or no action upon their contents, the gaſtric juice being fully ſufficient to break down the food, and reduce it to a pulp.

With regard to man, Dr Stevens, in an Inaugural Diſſertation concerning Digeſtion, publiſhed at Edinburgh in the year 1777, made ſeveral experiments upon a German, who gained a miſerable livelyhood by ſwallowing ſtones for the amuſement of the people. He began this ſtrange practice at the age of ſeven, and had at that time continued it about twenty years. He ſwallowed ſix or eight ſtones at a time, ſome of them as large as a pigeon's egg, and paſſed them in the natural way. Dr Stevens thought this poor man would be an excellent ſubject for aſcertaining the ſolvent power of the gaſtric juice in the human ſtomach. The Doctor, accordingly, made uſe of him for this purpoſe. He made the German ſwallow a hollow ſilver ſphere, divided into two cavities by a partition, and perforated with a great number of holes, capable of admitting an ordinary needle. Into one of theſe cavities he put four ſcruples and a half of raw beef, and into the other five ſcruples of raw bleak. In twenty-one hours the ſphere was voided, when the beef had loſt a ſcruple and a half, and the fiſh two ſcruples. A few days afterwards, the German ſwallowed the ſame ſphere, which contained, in one cavity, four ſcruples and four grains of raw, and, in the other, four ſcruples and eight grains of boiled beef. The ſphere was returned in forty-three hours: The raw fleſh had loſt one ſcruple and two grains, and the boiled one ſcruple and ſixteen grains. Suſpecting that, if theſe ſubſtances were divided, the ſolvent would have a freer acceſs to them, and more of them would be diſſolved, Dr Stevens procured another ſphere, with holes large enough to receive a crow's quill. He incloſed ſome beef in it a little maſticated. In thirty-eight hours after it was ſwallowed, it was voided quite empty. Perceiving how readily the chewed meat was diſſolved, he tried whether it would diſſolve equally ſoon without being chewed. With this view, he put a ſcruple and eight grains of pork into one cavity, and the ſame quantity of cheeſe into the other. The ſphere was retained in the German's ſtomach and inteſtines forty-three hours; at the end of which time, not the ſmalleſt quantity of either pork or cheeſe was to be found in the ſphere. He next ſwallowed the ſame ſphere, which contained, in one partition, ſome roaſted turkey, and ſome boiled ſalt herring in the other. The ſphere was voided in forty-ſix hours; but no part of the turkey or herring appeared; for both had been completely diſſolved. Having diſcovered that animal ſubſtances, though incloſed in tubes, were eaſily diſſolved by the gaſtric juice, the Doctor tried whether it would produce the ſame effect upon vegetables. He, therefore, incloſed an equal quantity of raw parſnep and potatoe in a ſphere. After continuing forty-eight hours in the alimentary canal, not a veſtige of either remained. Pieces of apple and turnip, both raw and boiled, were diſſolved in thirty-ſix hours.

It is a comfortable circumſtance, that no animal, perhaps, except thoſe worms which are hatched in the human inteſtines, can reſiſt the diſſolving power of the gaſtric juice. Dr Stevens incloſed live leeches, and earth-worms, in different ſpheres, and made the German ſwallow them. When the ſpheres were diſcharged, the animals were not only deprived of life, but completely diſſolved, by the operation of this powerful menſtruum. Hence, if any live reptile ſhould chance to be ſwallowed, we have no reaſon to apprehend any danger from ſuch an accident.

The German left Edinburgh before the Doctor had an opportunity of making a farther progreſs in his experiments. He therefore had recourſe to dogs and ruminating animals. In the courſe of his trials upon the ſolvent power in the gaſtric fluid of dogs, he found that it was capable of diſſolving hard bones, and even balls of ivory; but that, in equal times, very little impreſſion was made upon potatoes, parſnep, and other vegetable ſubſtances. On the contrary, in the ruminating animals, as the ſheep, the ox, &c. he diſcovered, that their gaſtric juice ſpeedily diſſolved vegetables, but made no impreſſion on beef, mutton, and other animal bodies. From theſe laſt experiments, it appears that the different tribes of animals are not leſs diſtinguiſhed by their external figure, and by their manners, than by the quality and powers of their gaſtric juices. Dogs are unable to digeſt vegetables, and ſheep and oxen cannot digeſt animal ſubſtances. As the gaſtric juice of the human ſtomach is capable of diſſolving, nearly with equal eaſe, both animals and vegetables, this circumſtance affords a ſtrong, and almoſt an irreſiſtible, proof, that Nature originally intended man to feed promiſcuouſly upon both.

Live animals, as long as the vital principle remains in them, are not affected by the ſolvent powers of the ſtomach. ‘ Hence it is,’ Mr Hunter remarks, ‘ that we find animals of various kinds living ‘ in the ſtomach, or even hatched and bred there; but the moment ‘ that any of theſe loſe the living principle, they become ſubject to ‘ the digeſtive powers of the ſtomach. If it were poſſible, for example, for a man's hand to be introduced into the ſtomach of a ‘ living animal, and kept there for ſome conſiderable time, it would ‘ be found, that the diſſolvent powers of the ſtomach could have no 'effect upon it: But, if the ſame hand were ſeparated from the body, and introduced into the ſame ſtomach, we ſhould then find, that the ſtomach would immediately act upon it. Indeed, if this were not the caſe, we ſhould find that the ſtomach itſelf ought to have been made of indigeſtible materials; for, if the living principle was not capable of preſerving animal ſubſtances from undergoing that proceſs, the ſtomach itſelf would be digeſted. But we find, on the contrary, that the ſtomach, which at one inſtant, that is, while poſſeſſed of the living principle, was capable of reſiſting the digeſtive powers which it contained, the next moment, viz. when deprived of the living principle, is itſelf capable of being digeſted, either by the digeſtive powers of other ſtomachs, or by the remains of that power which it had of digeſting other things.'

When bodies are opened ſome time after death, a conſiderable aperture is frequently found at the greateſt extremity of the ſtomach. 'In theſe caſes,' ſays Mr Hunter, 'the contents of the ſtomach are generally found looſe in the cavity of the abdomen, about the ſpleen and diaphragm. In many ſubjects, this digeſtive power extends much farther than through the ſtomach. I have often found, that, after it had diſſolved the ſtomach at the uſual place, the contents of the ſtomach had come into contact with the ſpleen and diaphragm, had partly diſſolved the adjacent ſide of the ſpleen, and had diſſolved the ſtomach quite through; ſo that the contents of the ſtomach were found in the cavity of the thorax, and had even affected the lungs in a ſmall degree.'

CHAPTER IX.

Of the Sexes of Animals and Vegetables.

SECTION I.

Of the Sexes of Animals.

ALL the larger and more perfect animals are diſtinguiſhed by the ſexes of male and female. The bodies of males, though not without exceptions, are, in general, ſtronger, larger, and more active, than thoſe of the females. In the human ſpecies, the male is not only larger than the female, but his muſcular fibres are firmer and more compact, and his whole frame indicates a ſuperior ſtrength and robuſtneſs of texture. He does not acquire his full growth, and beſt form, till he arrives at the age of thirty years. But, in women, the parts are rounder, and their muſcular fibres more feeble and lax than thoſe of men, and their growth and form are perfect at the age of twenty. A ſimilar obſervation is applicable to the minds of the two ſexes. Man is, comparatively, a bold, generous, and enterpriſing animal. Women, on the contrary, are timid, jealous, and diſpoſed to actions which require leſs agility and ſtrength. Hence they are entitled to claim, and, by their amiable weakneſſes, they actually receive our protection. Men are endowed with majeſty of figure and force of mind; but beauty, and the graces, are the proper characteriſtics of women. The laxity and ſoftneſs of their texture may, in ſome meaſure, account for the timidity and liſtleſſneſs of their diſpoſition; for, when the bodies of men are relaxed by heat, or by any other cauſe, their minds become not only timid, but weak, undetermined, and inactive.

The ſocial intercourſe of women ſoftens the diſpoſitions, and ſoothes the cares and labours of the men. Their little female humours, caprices, and follies, give riſe to many exertions of virtue. They excite in us compaſſion, humanity, and tenderneſs of affection. The delicacy of their bodies, and the weakneſs of their minds, require our ſupport and protection. In return, the gentle and inſinuating manners of the women have a direct tendency to ſoften and ſmooth the natural roughneſs of men. In moſt governments, women have the entire management and training of children, till their characters and diſpoſitions are almoſt fixed for life. This is an important office; and would require more education and ſenſe than they commonly receive either from nature or art. But their perſevering and unremitting attention to their charge, eſpecially when children are ſick or weakly, is ſo truly aſtoniſhing, that no man could have patience to perform the laborious and painful taſk. Women are likewiſe ſaid to ſuffer bodily pain with more reſolution than men. Women reaſon rapidly; but their reaſoning, though often acute, is ſeldom ſolid.

Modeſty is one of the moſt diſtinguiſhing and attractive characteriſtics of the female ſex. This is the great defence with which Nature has armed them againſt the artifices and deceit of the males. Modeſty has a double effect: It both attracts and repels. It heightens the deſire of the male, and deters him from rudeneſs, or improper behaviour. Were women deprived of this amiable quality, all their charms would vaniſh, and the ardour of love would be extinguiſhed. It is, therefore, not only the intereſt of females to cultivate modeſty, but to guard, with the moſt anxious attention, againſt the ſmalleſt incroachments. Every attack, however apparently inſignificant, ſhould be repelled with ſpirit and intrepidity. To men of ſenſibility, a ſingle glance of the eye will tell them that their conduct is improper, and make them not only inſtantly deſiſt, but prevent every future attempt. There is no part of the female character which men revere ſo much as modeſty. It is the brighteſt and moſt valuable jewel with which a woman can be adorned. A fine woman without modeſty, inſtead of gaining the affections of men, becomes an object of contempt, and even of diſguſt. It is equally the intereſt of men to cheriſh, and not to injure by indelicacy, a quality from which they derive ſo much pleaſure and advantage.

It is not unworthy of remark, that modeſty is by no means confined to the human ſpecies. Evident traces of it are diſcoverable in the brute creation. Even ſo low as the inſect tribes, moſt females repel the firſt attacks of the males. If this is not modeſty, it has all the effects of it; for it heightens the reſpect and affection of the males, and makes them employ every alluring art to procure the regard of the female.

It is a curious fact, that moſt carnivorous quadrupeds are more averſe from devouring women than men. The bears of Kamtſchatka follow the women when gathering wild fruits in the woods, and, though moſt rapacious animals, do them no farther harm than robbing them of part of the fruit *. The aſpect of man being more bold,

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* Gazette Literaire, vol. 1. p. 482.

bold, may, perhaps, create an idea of competition and danger, and excite the ferocity and courage of the animal. There ſeems to be an inſtinctive reſpect, if not dread, of the human kind implanted in moſt animals. If this be the caſe, the above fact amounts to a high compliment to the women; for they receive more favour from the brute creation than the men.

With regard to animals, in general, the intercourſe of ſexes is neceſſary for the multiplication of the ſpecies. But, as formerly remarked *, ſeveral of the lower tribes are enabled to multiply without the intervention of ſexes. In ſome animals, both ſexes are combined in each individual. The earth-worm, ſnails, and ſeveral ſhell-fiſhes, are hermaphrodites; and yet the conjunction of two is neceſſary for their multiplication. Mr Adanſon, in his Account of Senegal, mentions ſome ſhell-animals which, in order to produce, require the union of three individuals. In the polypus, no appearance of ſexual diſtinction has hitherto been diſcovered. Nature, however, has not denied them the power of multiplication, which is effected in a very ſingular manner †. Caterpillars of every denomination are totally deſtitute of ſexes, and are incapable, while they remain in that ſtate, of multiplying their ſpecies. But, after their transformation into flies, the diſtinction of ſexes is apparent, and their fertility is exceedingly great.

Among the larger animals, the difference of ſize and figure between males and females is not remarkable. The moſt ſtriking diſtinctions ariſe from the horns, the tuſks, the creſt, &c. which adorn the head of the male, and are often wanting in the female. But, among the inſect tribes, ſome males differ ſo greatly from the females, that they have the appearance of belonging to a ſeparate genus.

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* See chap. 1. pag. 30. &c.

† Ibid.

nus. In ſome butterflies, for example, the female is deſtitute of wings, while thoſe of the male are very large. The male and female of thoſe animals called *gall-inſects* bear no proportion to each other, either in ſize or in figure. They adhere for ſeveral months to the ſtems and branches of plants, ſhrubs, and trees, without any apparent movement. They have every appearance of galls, being of a ſpherical or oval figure, from which circumſtance they have received their denomination, and were long conſidered as vegetable ſubſtances deſtitute of every degree of animation. Reaumur, however, by a ſtrict examination of the changes they undergo, and of their internal ſtructure, diſcovered that they belong to the animal kingdom. He found that they contained thouſands of ſmall eggs, and that, from theſe eggs, ſmall animals were produced, which ran about with ſome quickneſs, and ſpread themſelves all over the tree or buſh. After ſome days, they attach themſelves to the ſtem and branches, remain immoveable, and gradually increaſe to their full dimenſions, when their bodies are found to contain numbers of eggs. As the perfect animal had no apparent motion, and yet multiplied its ſpecies, it was firſt thought to be an hermaphrodite of a ſingular kind, and that it was capable of producing without any foreign aid. But Reaumur diſcovered that they were impregnated by ſmall flies, and that theſe ſmall flies were male gall-inſects. The head, the body, the breaſt, and the ſix limbs of this fly, are of a deep red colour; and the wings, which are proportionally large, are white, bordered with a band of fine carmine red. In the month of April, he perceived numbers of theſe flies wandering about on the gall-inſects. He obſerved that they pierced the covering of the gall-inſects with a kind of ſting ſhaped like a needle. This circumſtance created a ſuſpicion that theſe flies were the males, and that this was their mode of impregnating the eggs of the female. To aſcertain this point, he opened a number of gall-inſects, which had no uncommon appearance, and, in ſome of them, he found the males, in every ſtage of their exiſtence, till they pierced the external covering, came out in the form of perfect flies, and attached themſelves, as uſual, to the females. The glow-worm, an animal condemned to crawl perpetually on the ſurface of the earth, is a female; and the male, inſtead of a reptile, is a ſcarabaeus, or beetle, furniſhed with four wings. A ſpecies of phoſphorus, emitted from the body of the female, excites the attention of this apparently ſtrange male, who darts down upon her, and actually enables her to continue the kind *. The female of another ſpecies of beetle is a perfect reptile, and has not the ſmalleſt veſtige of wings. But the male is a real beetle with four wings, and is ſo diſproportioned to the female in ſize, that their junction ſhould appear to be equally ſingular as that of a ram with an elephant. With regard to the pucerons, or vine-fretters, the males are winged; but the females remain during life totally deſtitute of wings. In ſome ſpecies of them, however, the females have wings, and theſe inſtruments of motion are denied to the males. Between the ſize of the male and female pucerons, there is likewiſe a remarkable diſproportion. The males, particularly thoſe which have no wings, are ſo comparatively ſmall, that they run about, like the male gall-inſects, upon the backs of the females. While this exerciſe continues, which is often very long, the female remains almoſt motionleſs. The more inſenſibility and liſtleſſneſs ſhown by the female, the male exhibits the greater ardour and agility. In this ſituation he paſſes whole days without taking any nouriſhment.

In birds of prey, the females are larger, ſtronger, fiercer, and more beautiful than the males. This ſuperiority of ſtrength and magnitude is conferred on the females, becauſe, in general, they are obliged to procure food both for themſelves and for their progeny. Vultures, however, are to be excepted; for the males are equal in

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* Reaumur. Oeuvres de Bonnet, tom. 2. p. 87. edit. 8vo.

ſize, if they do not exceed that of the females. In the gallinaceous tribe of birds, on the contrary, the males are larger, more beautiful, and more courageous, than the females. The peacock, the turkey, the pheaſant, and the dunghill cock, are remarkable examples. Dunghill cocks, eſpecially that kind of them which are called *game-cocks*, are the moſt intrepidly bold and high-ſpirited animals in the creation. Nothing but abſolute death can make them yield to an antagoniſt. In the domeſtic ſtate, at leaſt, this intrepidity, and this daring ſpirit, reſult from competition, and jealouſy of rivals. Game-cocks, to the diſgrace of humanity, are fed and trained with the moſt ſcrupulous attention. For what purpoſe? For the cruel amuſement and fortuitous emolument of gamblers.

That there are natural hermaphrodites, I have formerly mentioned. But, in man, dogs, cats, unnatural hermaphrodites, if they ever exiſt, are ſo rare, that the celebrated anatomiſt, Mr Hunter, declares he never ſaw a ſingle example. But, in the horſe, the aſs, black-cattle, and ſheep, he has ſeen many hermaphrodites. It is ſaid to be a known fact, that, when a cow brings forth two calves, one of them a male, and the other a female, the female is incapable of propagation, but that the male is a perfect animal. In England, a cow-calf brought forth with a bull-calf is denominated a *free martin*, and is as well known among farmers as either cow or bull. Mr Hunter remarks, that a cow-calf, brought forth in the ſituation above mentioned, may be either a free martin or a perfect female. 'For,' he remarks, 'I have reaſon to believe, that, in 'black cattle, ſuch a deviation may be produced without the cir-'cumſtance of twins; and, even when there are twins, the one a 'male, the other a female, they may both have the organs of gene-'ration perfectly formed *.' What is called a *free martin*, or imperfect

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* Hunter's Obſervations on the Animal Oeconomy, p. 49.

perfect hermaphrodite, as far as obſervation has hitherto extended, is confined to black-cattle. The free martin has all the external characteriſtics of a female calf. When animals of this deſcription are preſerved by farmers, it is not for the purpoſe of propagation, but for yoking with the oxen, or fattening for the table. They neither breed, nor, what is curious, do they diſcover the ſmalleſt inclination for the male, nor does the bull pay the leaſt attention to them.

The free martin, in figure, reſembles the ox, or ſpayed heifer. It is conſiderably larger than the bull or cow, and its horns are ſimilar to thoſe of the ox. 'The belly of the free martin,' ſays Mr Hunter, 'is ſimilar to that of an ox, having more reſemblance to that of 'the cow than of the bull. Free martins are very ſuſceptible of 'growing fat with food. The fleſh, like that of the ox, or ſpayed 'heifer, is in common much finer in the fibre than either the bull 'or cow, and is ſuppoſed to exceed that of the ox or heifer in delicacy of flavour, and bears a higher price at market *.' The Romans ſeem to have had ſome knowledge of free martins, though they have not tranſmitted to us any peculiarities in the ſtructure of theſe animals. With them, *taurus* was the generic name of the ox kind. They likewiſe mention *taurae*, by which, it is thought, they meant barren cows. Columella, when talking of cattle, ſays, 'and, 'like the *taurae*, which occupy the place of *fertile* cows, ſhould be 'rejected †.' Varro likewiſe informs us, that 'the cow which is '*barren* is called *taura*.'

Mr Hunter gives an anatomical deſcription of three free martins, the moſt perfect of which we ſhall tranſcribe.

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* Hunter's Obſervations on the Animal Oeconomy, p. 50.

† Columella, lib. 6. cap. 22.

' *Mr Arbuthnot's Free Martin* *.

' The external parts were rather ſmaller than in the cow. The ' vagina paſſed on, as in the cow, to the opening of the urethra, ' and then it began to contract into a ſmall canal, which paſſed on ' to the diviſion of the uterus into two horns; each horn paſſed ' along the edge of the broad ligament laterally towards the ovaria. ' At the termination of theſe horns were placed both the ovaria ' and the teſticles; both were nearly of the ſame ſize, which was ' about as large as a ſmall nutmeg. To the ovaria I could not find ' any Fallopian tube. To the teſticles were vaſa deferentia; but ' they were imperfect. The left one did not come near the teſticle; ' the right one came cloſe to it, but did not terminate in a body called the epididymis. They were both pervious, and opened into ' the vagina near the opening of the urethra. On the poſterior ſurface of the bladder, or between the uterus and bladder, were the ' two bags called *veſiculae ſeminales* in the male, but much ſmaller ' than what they are in the bull. The ducts opened along with the ' vaſa deferentia †.'

SECTION

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* ' This animal was ſeven years old, had been often yoked with the oxen, at other ' times went with the cows and bull, but never ſhowed any deſires for either the one ' or the other.'

† Hunter's Obſervations on the Animal Oeconomy, p. 52.

SECTION II.

Of the Sexes of Plants.

WHEN an hypotheſis, or theory, has obtained a general reception among even the enlightened part of mankind, it is extremely difficult to eradicate the prejudice, either by arguments or by facts. There is not a notion more generally adopted, than that vegetables have the diſtinction of ſexes, and that the influence of what is called the male is indiſpenſibly neceſſary to the fecundation of the female, or ſeed-bearing plant: A notion which I have long conſidered as a ſtriking example of the danger of raſhly yielding aſſent to the alluring ſeductions of analogical reaſoning *.

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* The ſubſtance of the following facts, and reaſoning, was delivered, above twenty years ago, in the Botanic Garden at Edinburgh, in preſence of the late worthy and learned Dr Hope, and his ſtudents. Dr Hope, in order to excite induſtry and attention in his pupils, appointed annually four of their number to give a lecture, or diſcourſe, upon ſome botanical ſubject, which he preſcribed to them. To me the Profeſſor aſſigned the Sexes of Plants, with the liberty of oppoſing the doctrine of Linnaeus, and his own. Being at that time a very young man, and a ſtrict believer in the ſexual ſyſtem of plants, I willingly undertook the taſk, becauſe I thought I had the chance of ſhowing ſome little ingenuity in attempting to ſhake a theory which I then imagined to be eſtabliſhed upon the firmeſt baſis of fact and experiment. But, after

Every perſon who is acquainted with the ſexual theory of vegetables, and with the arguments by which it is defended, muſt acknowledge, that its principal ſupport is derived from the many beautiful analogies which ſubſiſt between plants and animals. Becauſe all animals were ſuppoſed to propagate by ſexual embraces, and becauſe plants reſembled animals in their growth, their nouriſhment, their diſſemination, and decay, it was therefore concluded, that all vegetables were either male, female, or hermaphrodite; and that ſexual commerce was equally neceſſary for the fecundation of the vegetable as of the animal tribes.

This analogy was plauſible, and ſeemed to beſtow a ſplendid uniformity on the conduct of Nature. But experiment, the only teſt of natural truths, has totally annihilated this beautiful fabrick. The numberleſs ſpecies of vine-fretters, of polypi, of millepedes, and of infuſion animalcules, multiply, without having recourſe to the common laws of generation. Here, then, the analogy ſtops; and, inſtead of bringing aid to the ſexualiſt, operates powerfully againſt his favourite hypotheſis. If many ſpecies of animals are deſtitute of all the endearments of love, what ſhould induce us to fancy that the oak or the muſhroom enjoy theſe diſtinguiſhed privileges?

The analogy, beſides, is frequently contradicted in the ordinary oeconomy of vegetables. It is univerſally allowed, for example, that, even in oviparous animals, the eggs can only be impregnated while they are in a gelatinous or mere embryo ſtate. When farther advanced, their membranes, or ſhells, acquire a conſiſtence ſufficient to reſiſt the male influence. But, among the vegetable tribes, every

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after peruſing Linnaeus's works, and many other books on the ſubject, I was aſtoniſhed to find, that this theory was ſupported neither by facts nor arguments, which could produce conviction even in the moſt prejudiced minds. This diſcourſe was afterwards publiſhed in the firſt edition of the Encyclopedia Britannica.

every circumſtance is reverſed. In moſt hermaphrodite plants, (I muſt ſpeak in the language of the ſyſtem), the ſeeds are not only not in a gelatinous ſtate, but have acquired conſiderable bulk and ſolidity, long before the pollen, or ſuppoſed fecundating duſt, is thrown out of its capſules.

The ſame remark is applicable to dioicous plants, or ſuch as are barren and ſeed-bearing in different individuals. What concluſion is here to be drawn? Analogy fails; and facts contradict the analogy. The pollen of moſt plants ſheds after the ſeeds of their reſpective ſpecies are far advanced in ſize and conſiſtence. If this pollen had the power of fecundating, it could ſeldom impregnate plants of its own ſpecies; becauſe, when it is diſcharged, the ſeeds are paſt the proper ſeaſon; but, by flying promiſcuouſly abroad, this pollen might impregnate different ſpecies which happened then to be in a fit condition for the reception of male influence. Conſider the conſequences of ſuch an arrangement. Is not this to make Nature operate againſt her own intentions? Nature intends that plants ſhould multiply and perpetuate their kinds; but the ſexual hypotheſis makes her take the moſt effectual meaſures to prevent that intention, and to introduce univerſal anarchy among the vegetable tribes. Were this theory true, the whole vegetable kingdom, in a few years, would be utterly confounded: Inſtead of a regular ſucceſſion of marked ſpecies, the earth would be covered with monſtrous productions, which no botaniſt could either recogniſe or unravel.

The propagation of plants by ſuckers, ſlips, and cuttings, is a curious fact in the hiſtory of vegetation. The ſtrawberry is commonly raiſed by ſlips taken from the old root, or by ſuckers ſent off from the plant. In either of theſe methods, the plants flouriſh, and produce fruit. Many bulbous and eye-rooted plants, and moſt ſhrubs and trees, may be propagated in the ſame manner. Where, it may be aſked, do theſe plants procure impregnation? That they grow, and produce fertile fruit, is undeniable; and yet, according to the ſexual hypotheſis, the pollen of the male is indiſpenſibly neceſſary to the ripening and fertilization of the fruit. By means of ſuckers, ſlips, cuttings, and layers, the whole globe might be ſpread over with vegetables, without the poſſibility of a ſingle impregnation.

Though the argument from analogy ſhould be inconcluſive, yet, ſay the ſexualiſts, we appeal to facts. I ſhall, therefore, give a ſhort view of the principal facts employed to ſupport the ſexual intercourſe of plants.

After what has been remarked, it will not be expected that I ſhould mention thoſe parts of Linnaeus's reaſoning which are derived from analogy. In many inſtances, he has puſhed analogy ſo far beyond all decent limits, that it becomes truly ridiculous. For example, he gravely tells us, 'That the calix repreſents the marriage *bed;* the corolla the *curtains;* the filaments the *ſpermatic* '*veſſels;* the antherae the *teſtes;* the pollen the *male ſemen*; the 'ſtigma the extremity of the *female organ;* the ſtylus the *vagina;* 'the germen the *ovarium;* the pericarpium the *impregnated ovarium;* and the ſeeds the *eggs* *.'

The moſt plauſible fact in favour of the ſexual hypotheſis is derived from the culture of the date-bearing palm-tree. Haſſelquiſt †, and ſome other travellers, mention their having ſeen flowering branches of male trees fixed to the females by Arabian gardeners, who alledged, that, unleſs this operation were performed, their dates would neither be good nor plentiful. This practice can boaſt of an antiquity long prior to the notion of ſexes in plants. How it came to be introduced, it is of little importance to inquire. We know that the cuſtom is ſtill ſaid to prevail: But we likewiſe know, that there is not an authentic fact which ſhows any connection between the *practice* and the *event*, though that be an eſſential ingredient in the controverſy. The eaſtern nations are famous for introducing ſuperſtition into every part of their oeconomy; and it is equally difficult to account for their manners as for their culture of palm-trees.

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* Sponſalia Plantarum, in Amoen. Acad. vol. 1. p. 103.

† Haſſelquiſt's Travels, p. 112. 416. Kempfer. Amoen. p. 706. Tournefort Iſag. p. 69.

Mylius's letter to Dr Watſon, recorded in the Philoſophical Tranſactions, is an attempt to remove this difficulty, and to ſhow a neceſſary connection between the male and female palm. Mylius writes to his correſpondent, 'That a female palm-tree grew many years 'in the garden belonging to the Royal Academy at Berlin, without 'producing any ripe or fertile fruit; that a male branch, with its 'flowers in full blow, was brought from Leipſic, about twenty German miles from Berlin, and ſuſpended over the female tree. The 'reſult was, that the female yielded, the firſt year, 100 ripe dates. 'The ſame experiment being repeated the following year, 2000 ripe 'fruit were produced.'

Not to call Mylius's veracity in queſtion, the experiment is both inconcluſive and defective. Berlin is not the climate of palm-trees. The tree, he informs us, bore flowers and fruit for thirty years before the trial was made; but the fruit, it is ſaid, never came to maturity. Plants ſeldom produce ripe fruit in a climate not adapted to their nature, until they have grown there a long time. Mylius's palm-tree had carried unripe fruit for thirty years. According to the uſual courſe of exotic plants, therefore, it is natural to think, that, like the American aloe, the tree, during all this time, was making gradual advances toward perfection; that, when the male branch happened to be ſuſpended over the female, the plant had arrived at the higheſt degree of maturity it could ever acquire in the climate of Berlin; and, of courſe, that the accidental circumſtance of ſuſpending the male branch over it, at this critical period, might give riſe to the deception of attributing the ripening of the fruit to the preſence of the male branch. The production of 100 ripe fruit only the firſt year, and 2000 the ſecond, is a ſtrong corroboration of this account of the matter. At any rate, the experiment is exceedingly defective and unſatisfactory. To convince any man that the fertility of this tree was ſolely owing to ſome impregnating virtue communicated to it by the male, a branch ſhould have been ſuſpended over the female one year, omitted the next, and ſo on alternately for a ſucceſſion of ſeaſons, or, as the ſexualiſts would expreſs it, giving her a huſband one year, and denying her that gratification the next. After treating the female in this manner, if it had uniformly happened, that the fruit ripened every year the male branch was ſuſpended, and that none came to maturity when that operation was omitted, then there would have been ſome foundation for ſuppoſing a connection between the ripening of the fruit and the preſence of the male branch. But, as this neceſſary precaution was omitted, the experiment is incomplete, and the concluſion drawn from it precipitate and unphiloſophic.

In accounting for the fecundity of all the *dioicous* * and *monoecious* † plants, the ſexualiſts have recourſe to the aid of the winds, and of inſects. They betake themſelves to this ſtrange refuge, in order to explain the manner in which female plants, when ſituated at a diſtance from males, are impregnated. Some of them, as Kalm, and others, are perfectly ſatisfied with this ſuppoſed aerial commerce of vegetables, even when the males are ten, fifteen, or twenty miles diſtant from the females! Here, it may be remarked, that the multiplication of ſpecies is one of the moſt important laws of Nature. All the laws of Nature are fixed, ſteady, and uniform, in their operation: None of their effects are abandoned to thoſe uncertainties which neceſſarily reſult from chance, or from any fortuitous train of circumſtances. But, is there any thing, in northern climates at leaſt, more deſultory and capricious than the direction and motion of the winds? Can we form a conception of any thing more caſual and uncertain than the wayward paths of inſects? The very ſuppoſition, therefore, that Nature has expoſed the fertility of a tenth part of the whole vegetable kingdom, and many of them, too, plants of the utmoſt importance to man, and other animals, to ſuch accidental cauſes, is repugnant to every idea of ſound philoſophy. Beſides, the reverſe has been proved by Dr Alſton, Camerarius, and Tournefort. Theſe gentlemen reared female plants of the ſpinage and hemp in ſuch ſituations, and with ſuch ſcrupulous precautions, to prevent any ſuppoſed impregnation by means of the wind, or of inſects, that it is difficult to conceive the poſſibility of any communication between the males and females. Theſe females, however, produced fertile ſeeds in the greateſt abundance.

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* Plants which have the male character in one individual, and the female in another.

† Plants which have both the male and female characters in the ſame individual.

Since theſe experiments were made, it has been diſcovered, that male flowers are ſometimes found lurking on the female plants of the ſpinage and hemp: And this diſcovery the ſexualiſts think ſufficient to account for the ſucceſs of Dr Alſton's experiments. But, inſtead of ſolving the difficulty, this circumſtance ſeems to involve it in ſtill deeper obſcurity: For, that the pollen iſſuing from the antherae of a male flower or two ſhould riſe, fall, and turn round in every direction, ſo as to light preciſely on the ſtigmata of all the ſuperior, inferior, and circumjacent female flowers, appears to exceed the common powers of human faith. Beſides, this circumſtance would ſeem to indicate, that there is no ſteadineſs in what is called *vegetable ſexes*. We are even told, that trees, which had continued many years under the character of females, but, from ſome ſtrange metamorphoſis, had ſuddenly dropped their female forms, and aſſumed the more robuſt features peculiar to the male part of the creation!

It was hinted above, that all the dioicous, monoecious, as well as moſt of the hermaphrodite flowers, being impregnated by means of the wind, ſeemed not to accord with the rules of philoſophizing; we ſhall now examine that doctrine more cloſely.

The pollen is allowed to be too large to get admiſſion into the ſtigmata, though laid upon them with the greateſt dexterity. This difficulty the ſexualiſts imagine to be removed, when they tell us, that moiſture makes the pollen ſplit, and diſcharge a ſubtile aura, and that this aura impregnates the ſeeds. But, though the pollen ſhould explode by the application of moiſture, and diſcharge a ſubtile aura, this exploſion could never effect the purpoſes of impregnation: For, when the pollen was lying on the ſtigma, the aura muſt neceſſarily blow off, inſtead of being abſorbed by that part of the plant. Is not the ſuppoſition ſingular, and even contradictory, that a plant ſhould be impregnated by a ſubſtance forcibly blown away from the female?

This reaſoning proceeds upon the admiſſion, that the pollen is laid with dexterity upon the ſtigma. But it will receive additional force, when I defy all the naturaliſts in the univerſe to produce an inſtance of a ſingle grain of pollen being ever ſeen on any part of a female plant, even when at no great diſtance from a male, far leſs upon the ſtigmata of each ſeparate flower. Granting, however, the pollen to be carried off from the male by the wind, yet, as the ſuppoſed fecundating aura it contains is much lighter than air, and is diſcharged by the ſlighteſt moiſture, it can never fall down upon the diſtant females, but muſt riſe and diſſipate in the higher regions of the atmoſphere. It may alſo be diſcharged by the application of rain or dews before the pollen is carried off by the wind from the male flowers: And, if the winds blow in a direction contrary to the ſituation of the female plants for a few critical hours, the females muſt be rendered barren, at leaſt for a ſeaſon.

It is an eſtabliſhed fact, that coleworts, turnips, &c. when growing in gardens, ſometimes produce new varieties. Theſe varieties the ſexualiſts uniformly hold up as inſtances of hybrids, or mongrels, from fortuitous commixtures of different males and females. This concluſion, however, ſeems to be precipitate. It is well known to nurſerymen and gardeners, that, from ſeeds of the ſame individual plants, varieties ſometimes appear. If theſe varieties chance to have any qualities ſuperior in value to the original plants, their ſeeds, ſhoots, or ſlips, are collected, and the new kind is propagated with diligence. That the beauty of flowers, and the magnitude and flavour of fruits are improveable by particular modes of culture, and even by unknown accidents, is an undeniable truth: That theſe improved qualities, in whatever manner procured, continue in the kind, unleſs allowed to degenerate by negligence, is not leſs true. But there is nothing ſo wonderful in theſe phenomena as to require the moſt unbounded ſtretches of fancy to account for them. Are not the beauty, ſtrength, and magnitude of animals, equally improveable by culture? Does not an ox, tranſported from the comparatively barren mountains of Scotland, to the rich paſtures of Yorkſhire, aſſume qualities very different from thoſe he originally poſſeſſed.?

Why, then, ſhould an inconſiderable change in the conſtitution of a colewort, or a turnip, excite ſurpriſe? Plants are liable to be diverſified by numberleſs accidents. Perpetually fixed to the ſame local ſituation, they muſt receive, indiſcriminately, ſuch nouriſhment as is tranſmitted to them by the earth and air. When different kinds happen to grow very near each other, and, as they have not the choice of rejecting ſuch food as is preſented to them, may not exudations from the one be abſorbed by the roots of the other? May not the matter which tranſpires ſo copiouſly from the leaves and flowers of one plant be conveyed to, and abſorbed by, thoſe of a different kind? And may not this foreign nouriſhment occaſionally introduce ſome changes in the colour, texture, or flavour, of the leaves, flowers, or fruit? Nay, is it not reaſonable to ſuppoſe, that ſolutions of various mineral ſubſtances, the action of particular manures, and a thouſand other circumſtances, may often induce ſuch changes? Why, then, ſhould we have recourſe to unnatural and ſtrained analogies, when the phenomena may be ſolved upon the principles of ſound philoſophy?

The learned Dr Hope, late Profeſſor of Botany in the Univerſity of Edinburgh, who was a ſtrenuous ſupporter of vegetable ſexes, thought he had almoſt eſtabliſhed the theory by the following experiment upon the lychnis dioica, of which two varieties are natives of Scotland, the one bearing white, and the other red flowers. The Doctor, about twelve years ago, raiſed a white female and a red male under the ſame glaſs-bell, which was ſunk ſo far in the ſoil as to prevent all communication with other vegetables. The bell terminated in a tube, which, for the occaſional introduction of a little freſh air, was ſtuffed with moſs. The ſeeds of the white female were ſown next ſeaſon; and, inſtead of white, the plants produced red flowers, in conſequence, it was imagined, of the influence of the male upon the female. He likewiſe aſſerted, that the red kind, when left to Nature, never brought forth white flowers, nor the white kind red flowers.

Upon this experiment we have to remark, 1. That nothing is more dangerous, or more fallacious in philoſophy, than the aſſumption of general poſitions without an accurate inveſtigation. The Doctor advanced, for example, that the red and the white lychnis, when in a natural ſtate, never change their colours. This poſition is neither capable of admiſſion nor denial; becauſe no experiment, nor inquiry, ſeems ever to have been made on the ſubject: Yet it is aſſumed as a premiſe to the concluſion, that the change of the white into a red lychnis was occaſioned by the influence of the red male upon the white female.

2. That hybrids, or mules, uniformly participate of both the ſpecies or varieties by which they are engendered. A jack-aſs and mare never produce a ſimple aſs or horſe, but a mule, or mixture of the two. It ſhould ſeem, however, that this red lychnis transfuſed its own individual qualities, without allowing a ſingle particle of the female to appear. This is contrary to every analogy. If the change had originated from ſexual commixture, the progeny ought not to have been completely red, but pied, or a mixture of red and white. To whatever cauſe, therefore, this change may be attributed, it can never be aſcribed to any thing analogous to generation.

3. That colour is a delicate and fluctuating quality. It depends ſo much on light, air, health, and perhaps ſome unknown cauſes, that botaniſts, with great propriety, have rejected it as a ſpecific character. Suſpecting that cauſes of this nature might change the colour of the white lychnis under conſideration, I examined the condition of ſome plants then ſubjected to the ſame trials in our Botanic Garden. The flowers both of the red and white lychnis

were then in full blow under the bell, the glaſs of which was thick, and of a darker green than our common beer-bottles. The light, of courſe, tranſmitted to the plants was lurid and obſcure. They were alſo deprived of a free circulation of air. Under theſe unnatural circumſtances, the plants had a ſickly aſpect. The flowers of the red variety, inſtead of a vivid red, were almoſt perfectly white. Here we have nearly an equal change made upon the ſame plant, without the poſſibility of its being effected by the intercourſe of ſexes. If plants are thus deprived of proper light and air, it cannot be ſurpriſing to ſee changes produced in the colour of their immediate deſcendents. The contaminated air eſcaping from the plants themſelves, and from the ſoil under the bell, may be ſufficient to produce this effect. I formerly mentioned, that the colour, and other qualities of plants growing near each other, may be changed by abſorbing the matter of tranſpiration and exudation. The argument is applicable with peculiar force to plants impriſoned ſo cloſely, and having ſo little acceſs to freſh air. In this ſituation, they muſt, of neceſſity, feed upon each other. Confine a man and a woman for years in a ſmall ill-aired cell, and obſerve their aſpect, and that of their progeny. Their appearance will be very different from that of children produced by healthy parents, and enjoying the benefits of the ſun's rays, and of the open air.

4. That, independently of all theſe arguments, the experiment is incomplete. Even on the ſuppoſition of the exiſtence of ſexes in plants, the concluſion drawn from it cannot be admitted. The ſame change, for inſtance, might have happened, if, inſtead of a white female and red male, a white female had been impriſoned with a red female. In this caſe there could be no commixture of ſexes; and yet, it is highly probable, that both would have ripened their ſeeds, and that theſe ſeeds would have produced plants differently coloured from the ſame varieties growing in a natural ſtate. Till theſe indiſ-

penſible parts of the experiment, therefore, be tried, nothing can be concluded in favour of the ſexual ſyſtem.

5. That flowers growing from the ſame root, fruits upon the ſame tree, or raiſed from ſeeds of the ſame individual plant, often vary in colour, ſize, figure, and texture. Theſe varieties are apparent to the moſt ſuperficial obſervers; but they can never, with any degree of propriety, be aſcribed to the influence of ſex. The cauſes of ſuch variations are rather to be looked for in the expoſure of the plants with regard to light and air, the nature of the ſoil, the mode of culture, accidental injuries from dews, from electrical fire, from the poiſon or wounds of inſects, and from the abſorption of mineral ſolutions. In a word, if we are to hope for an explanation of theſe, and other minute changes in the appearances of plants, recourſe muſt be had to chemical and philoſophical principles, and not to an hypothetical commerce of ſexes.

The diſcourſe was concluded with the following ſentiment:—But I aim not at complete refutation; for experiments are ſtill to be made. I only wiſh to render the ſexual commerce of plants ſuſpicious, that the minds of men may be freed from the fetters of a ſyſtem, which has, perhaps, too long received the general aſſent of Europe; and that the oeconomy of the vegetable kingdom may again be open to impartial inveſtigation.

To remove the poſſibility of male influence being conveyed by means of the wind, or of inſects, about ten or twelve years ago, I thought, if a female plant could ripen her ſeeds within doors during the winter, the experiment would infallibly determine the controverſy. With this view, I confined a female lychnis, which is a native plant of this country, and gave her ſuch a degree of heat as made her produce flowers three months before any male flowers of the ſame ſpecies were blown in Britain. The flowers and the young ſeed had every appearance of health and vigour. But the plant itſelf, as uſually happens to vegetables when forced to grow in unnatural ſituations, was feeble, ſlender, and double the common length it acquires in the fields. I waited the event. My expectations, however, were diſappointed; for the flowers dropped long before the ſeeds were ripened. The plant was kept three years in the ſame ſituation; but ſtill the flowers dropped, and no ripe ſeeds were produced. As the health of plants, like that of animals, depends upon many circumſtances, as expoſure to the open air, to light, to the agitations of the wind, which to them anſwers the invigorating purpoſe of exerciſe, to nocturnal dews, to natural rains, inſtead of artificial waterings, &c. I reſolved to place the female lychnis in a ſituation where ſhe might enjoy all theſe advantages, and at the ſame time be removed from every ſuſpicion of a connection with male influence. For this purpoſe, I applied to my learned and ingenious friend Dr Daniel Rutherford, now Profeſſor of Botany in the Univerſity of Edinburgh, who, at that time, had a ſmall garden, or rather a little area, in the heart of the city, which was ſurrounded with houſes of five and ſix ſtories high, and diſtant from any male lychnis about an Engliſh mile. Dr Rutherford received this female lychnis into his garden. The firſt ſummer after her admiſſion, being enfeebled by her former three years confinement, ſhe dropped her flowers, without producing fertile ſeeds. During three or four ſucceeding years, however, ſhe remained in the ſame ſituation; and ſhe not only ripened her ſeeds, but theſe ſeeds vegetated, without the poſſibility of any male impregnation; for the Doctor, after the young plants were in a ſtate of diſcrimination, uniformly extirpated all the males, and never could diſcover the veſtige of a ſingle male upon the female plants. Her female progeny, however, continued to bear fertile ſeeds for ſeveral ſucceſſive generations. If, after this, and ſome experiments formerly mentioned, any ſexualiſt chooſes to have recourſe to the wind, and to inſects, he may enjoy his theory; but few men of penetration will join him in opinion.

But, if theſe facts and reaſonings ſhould not be ſufficient to convince every believer in the ſexual ſyſtem of plants that the hypotheſis has no foundation in Nature, Spalanzani, a late ingenious Italian naturaliſt, has, by a number of experiments, removed the poſſibility of any rational doubt on the ſubject.

Spalanzani, in order to make a complete inveſtigation of this ſubject, performed a number of experiments on what are called *hermaphrodite*, *monoecious*, and *dioicous* plants.

Hermaphrodite plants comprehend all thoſe which have ſtamina and piſtils, or the male and female organs, in the ſame flowers. To diſcover whether the pollen had any influence upon the fertility of the ſeeds, Spalanzani forced open the petals, or flower-leaves, ſome time before they began to expand. He then cut off all the ſtamina, or male parts, before the ſuppoſed foecundating duſt was ripe, leaving the female part to its fate. The reſult was, that, in many of the plants, the ſeeds did not ripen, or even acquire their full ſize; in others, they grew to the natural ſize; but, after being committed to the ground, they did not germinate. Above thirty years ago, a ſimilar ſet of experiments were made, in the Botanic Garden at Edinburgh, by the late Dr Alſton, the then Profeſſor of Botany. But, whether Dr Alſton's experiments were performed with greater dexterity than thoſe of Spalanzani, it is impoſſible to determine. The event, however, was the reverſe; for Dr Alſton's plants, which were treated in the ſame manner with thoſe of Spalanzani, not only ripened their ſeeds, but theſe ſeeds, when ſown, were found to be as fertile as if no ſuch operation had been performed. But no experiments of this kind can be made with any degree of certainty upon

hermaphrodite

hermaphrodite plants; becauſe they are impracticable, without wounding and injuring the tender flowers. By forcing open the petals ſome days before they would naturally unfold, the interior parts of the flowers are prematurely expoſed to the action of the air, of dews, and of the ſun's rays. Beſides, no man can determine what changes the young ſeeds may undergo, what injury they may ſuffer, by an unnatural deprivation of the ſtamina. In every flower treated in this rough manner, an extravaſation of ſap muſt unavoidably be produced. If a pregnant animal is wounded, and in a part too ſo intimately connected with the foetus, what reaſon have we to expect a fertile and well-proportioned offspring?

Spalanzani next proceeded to trials on the monoecious plants, or thoſe which bear both male and female flowers ſeparately on the ſame individual. In ſpring 1777, he ſowed two ſpecies of the pumpion, which belong to this diviſion of plants, in a ſituation removed from every ſuſpicion of foreign connection by means of the wind or of inſects. 'In the beginning of June,' ſays he, 'two individuals, for I had ordered two only to be raiſed, were juſt beginning 'to put forth a few flower-buds towards the bottom of the ſtalk. 'At this early period, the male flowers may be eaſily diſtinguiſhed 'from the female. The former, alſo denominated *barren* by botaniſts, have a ſlender ſtalk; while the ſtalk of the latter, where it 'joins the calyx, forms a tumor, conſiſting of the immature fruit. 'I paid daily viſits to theſe two individuals, and very carefully 'watched the progreſs of both ſorts of flowers. That there might 'be no ſuſpicion of the pollen exerting any influence upon the females, the males were deſtroyed at their firſt appearance. As fruit, 'when a ſmall quantity only is left upon a plant, is ſooner ripe, 'and grows to a larger ſize, becauſe it receives a greater quantity of 'nutritious juice, I left on each of my two individuals two flowers 'only. The buds that made their appearance afterwards were taken

‘ ken away, along with the male flowers. Meanwhile my four ‘ gourds grew rapidly. Finding that, towards the middle of September, they had attained the uſual full ſize, I gathered one, in ‘ order to inſpect the internal parts. The fleſh was too ſoft, becauſe ‘ the fruit was not thoroughly ripe; but, in colour, ſtructure, and ‘ taſte, it reſembled fruit produced by plants which had their male ‘ flowers.—The ſeeds were in great number, and, as well internally ‘ as externally, were perfectly formed.—At the end of the month, ‘ the other three gourds were quite ripe. I therefore gathered them, ‘ and put the ſeeds of each into a ſeparate box, that I might be able ‘ to examine them at pleaſure. The lobes filled the whole inſide of ‘ the ſeeds, and had all the characters of perfect maturity.

‘ Thus far,’ continues our author, ‘ there is a perfect agreement ‘ with the obſervations made on the ſeeds of ſome hermaphrodite ‘ plants, which ſeemed, notwithſtanding they were deprived of the ‘ efficacy of the pollen, to have acquired the ſame degree of perfection as thoſe impregnated in the uſual manner. But, as they ‘ did not grow, however perfect they might be in appearance, becauſe they had not been vivified by the pollen, I imagined, that, ‘ for the ſame reaſon, the ſeeds of my three gourds would not grow. ‘ It was, however, proper to make the experiment. I therefore ‘ dried one hundred and fifty in the ſun, and afterwards planted ‘ them in three pots, fifty in each, taken from ſeparate gourds. But ‘ the lateneſs of the ſeaſon, it being the 10th of October, the conſtant rain, and the coolneſs occaſioned by it, circumſtances unfavourable to vegetation, obliged me to place my pots in a ſtove, ‘ which, though it was not heated, was kept warm by a contiguous ‘ chimney. *The event did not by any means correſpond to my expectation.* I took it for *granted*, that *none* of the ſeeds would *germinate;* and yet they *almoſt all came up* very well [*].’

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[*] Spalanzani’s Diſſertations, vol. 2. p. 276. &c.

Here it is pleaſant to obſerve candour and fair experiment triumphing over deep prejudice. From the above, and many other paſſages, it is evident that Spalanzani was a keen ſexualiſt, and that he expected his experiments, inſtead of overthrowing, would confirm his faith; but, like a true philoſopher, he candidly, though with reluctance, unhinges his favourite opinion.

'I reſerved the remainder of the ſeeds,' continues Spalanzani, 'for another experiment to be made the following ſpring. Before 'it can be aſſerted that fructification has been complete, it is neceſ'ſary, according to the determination of botaniſts, not only that the 'ſeeds ſhould grow, but that they ſhould alſo be capable of bringing 'productive ſeeds, or, in other words, of perpetuating the ſpecies. 'That I might learn whether the ſeeds of my three gourds enjoyed 'this prerogative, I cauſed ſome of them to be planted in the ſame 'place in May 1778; and, when they were grown to ſome ſize, 'they were, as in the foregoing experiment, carefully ſtripped of all 'their male flowers, one female flower only being left on each in'dividual. Theſe flowers were furniſhed with ſmall gourds, which 'grew ripe towards the beginning of autumn, and the ſeeds they 'produced grew juſt as well as the former *.'

With regard to dioicous plants, or thoſe which produce male flowers on one individual and female flowers on another, they are by far the moſt unexceptionable ſubjects for determining the exiſtence or non-exiſtence of ſexes in plants. Accordingly, Bonnet, Fourgeroux, and Spalanzani, &c. about the year 1770, placed female plants of this deſcription in ſituations ſo ſtrictly guarded againſt the poſſibility of foecundating duſt being conveyed to the females either by the air or by inſects, that the ſuppoſition of male influence baffles

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[*] Spalanzani's Diſſertations, vol. 2. p. 278.

baffles all the powers of imagination. Theſe females, however, uniformly produced ripe ſeeds; and theſe ſeeds were as prolific as if they had been ſurrounded with males.

From the facts and arguments above related, and many others which might be adduced, it appears, that this beautiful theory, derived from a miſtaken analogy, has no foundation in Nature. I would not have dwelt ſo long on this ſubject, if I had not ſincerely wiſhed that the minds of men might be emancipated from the fetters of a ſyſtem which has too long received the almoſt univerſal aſſent of the literary world; and that the oeconomy of the vegetable kingdom may again be open to impartial inquiries.

CHAPTER X.

Of the Puberty of Animals.

THE puberty of animals commences at that period of their exiſtence when Nature endows them with the power of multiplying the ſpecies. This period is as various as the different tribes of animals. In ſome it arrives ſooner, in others later; but, in every animal, it is accompanied with ſome remarkable changes in conſtitution and affections. From infancy to puberty there is a gradual increaſe of ſize; but, immediately after that period, in both ſexes, the growth of the body makes a ſudden ſpring, and acquires redoubled ſtrength and activity. The growth of animals, however, does not always ſtop at the age of puberty. Men, quadrupeds, and fiſhes, continue to grow for ſome time after their capacity of multiplying. But moſt birds and inſects ſeem to acquire their full dimenſions before they arrive at the age of puberty.

Before puberty, the voice of a man, like that of a woman, is ſhrill and feeble. But, after that period, it becomes rough and ſtrong. This effect is produced by ſome unaccountable and ſudden change in the organs of ſpeech, which is not confined to the human ſpecies; for the voice of a horſe or a bull is deeper after than before puberty.

In eunuchs, no ſuch alteration of voice is to be obſerved; for their voice, though ſhrill and piercing, can never produce a low or deep note. At this period, too, that diſtinguiſhing characteriſtic of man, the beard, begins to appear, together with other external and internal changes, which it is unneceſſary to relate. But eunuchs are totally deſtitute of beards. Theſe two facts indicate a connection which merits the attention of philoſophers.

With regard to the female ſex, they are by no means exempted from conſtitutional changes when they arrive at the age of puberty. The alteration in the tone of their voice, if it does happen, is hardly perceptible. Neither are their faces deformed by a beard, which, according to our preſent ideas, would have a diſguſting effect. At this period, however, their mammae ſwell, and a periodical evacuation takes place, which produces wonderful revolutions in their conſtitution and affections. In both ſexes, the mental changes are not leſs remarkable than the corporeal. The powers of the mind expand, the force of genius is felt, and very different objects ſolicit attention: Inſtead of puerile amuſements, ambition, a warm and unaffected friendſhip, a generoſity and unſuſpicious demeanour, both in words and actions, are the almoſt univerſal characteriſtics of this period of human life. I mention it with pleaſure, that, as far as my obſervation extends, in youth, unleſs they are corrupted by example, by neglect, or by other cauſes, all men are honeſt, friendly, generous, and humane. If this remark be true, Nature is fully exculpated. But, when a young man enters into the buſineſs of life, his candour and ingenuouſneſs ſoon meet with a ſhock. This is the painful reverſe. Inſtead of liberality and integrity of conduct, he has to encounter with ſelfiſhneſs, chicane, and too often with direct villany. This unhappy diſcovery turns his thoughts into a different current, contracts the noble openneſs of his heart, renders him ſuſpicious and guarded, and, if he ſhall chance to retain his integrity, he is obliged to aſſume, at leaſt, the appearance of jealouſy and deceit. I by no means intend this to be the univerſal character of mankind; I only lament that it is too general.

In every race of mankind of which we have any knowledge, the females arrive ſooner at puberty than the males. But the age of puberty differs in different countries. This difference ſeems to originate from two cauſes, the temperature of the climate, and the quality of the food. Children of citizens, and of opulent parents, who are fed with rich and nouriſhing victuals, arrive ſooner at this ſtate. Children, on the contrary, brought up in the country, or whoſe parents are poor, require two or three years longer; becauſe their food is not only coarſe, but too ſparingly given. In the ſouthern regions of Europe, and in large cities, the females arrive at puberty about the age of twelve, and the males about fourteen. But, in northern climates, and in the country, girls hardly come to maturity till they are fourteen, and boys not before ſixteen. In the warmeſt regions of Aſia, Africa, and America, the age of puberty in females commences at ten, and ſometimes at nine.

After puberty, the Count de Buffon remarks, 'marriage is the 'natural ſtate of man. A man ought to have but one wife, and a 'woman but one huſband. This is the law of Nature; for the 'number of females is nearly equal to that of the males. Such laws 'as have been enacted in oppoſition to this natural principle, have 'originated ſolely from tyranny and ignorance. Reaſon, humanity, 'and juſtice, revolt againſt thoſe odious ſeraglios, in which the liberty and the affections of many women are ſacrificed to the brutal 'paſſion of a ſingle man. Does this unnatural pre-eminence render 'thoſe tyrants of the human race more happy? No! Surrounded 'with eunuchs, and with women who are uſeleſs to themſelves and 'to other men, they are tormented with the conſtant appearance of 'that accumulated load of miſery they have created.'

All animals, as well as thoſe of the human ſpecies, undergo, at the age of puberty, ſimilar changes in the form of their bodies, and in the diſpoſitions of their minds. From mild, placid, and gentle, they become bold, reſtleſs, and ungovernable. Their bodies are then, in ſtrength and ſymmetry, perfectly accommodated to the new ſentiments which Nature, for wiſe purpoſes, excites in their minds. In the deer kind, the horns of the males appear not till they are fit for multiplying the ſpecies. At this period, the creſt, the wattles, and the plumage of the male gallinaceous birds acquire additional beauty, and their courage and ſtrength are greatly augmented. The pigeon, inſtead of being querulous, timid, and voracious, whenever the age of puberty arrives, feels emotions of a very different kind. Conſcious of the new vigour he has acquired, he aſſumes a bold and important air. He ſtruts about with a majeſtic pride, and immediately addreſſes, with all the gaiety of a lover, ſome favourite female, whom he ſollicits with the moſt aſſiduous gallantry and attention. After the coy female gives her aſſent, their after conduct exhibits ſuch a mutual and ardent affection, and ſuch a conſtant fidelity, as afford no inconſiderable pattern to the human ſpecies.

With regard to fiſhes, we are totally ignorant of the periods when the different tribes of them acquire the power of multiplying. From the element they inhabit, from the rapidity of their motions, and from their deſultory and wandering mode of living, we are equally ignorant of many other important parts of their oeconomy and manners. This continues to be an ample field for future inveſtigation, and highly worthy of the attention of naturaliſts.

The oeconomy and manners of inſects are more open to inſpection. Thoſe of the winged tribes undergo many changes, both in figure and ſtructure, before they arrive at the age of puberty. They firſt eſcape from the eggs in the form of minute caterpillars. In this ſtate they are exceedingly voracious, and grow with rapidity to their full ſize; but they are deſtitute both of the power and of the organs neceſſary for the multiplication of the ſpecies. They are next tranſformed into chryſalids: In this ſtate, their bodies are covered with a kind of cruſt or ſhell, from which the animals have again to eſcape, as from a ſecond egg. In this impriſoned condition, they remain during a longer or ſhorter period, according to the ſpecies, or to the ſeaſon of the year in which they are transformed. After their transformation into flies, they burſt this cruſt or ſhell, and appear in the form of flies, furniſhed with wings, legs, feelers, &c. of all which they were deſtitute in their former ſtate. When tranſformed into flies, caterpillars have arrived at the age of puberty. They are now perfect animals, and endowed with the faculty of tranſmitting a numerous progeny to poſterity.

CHAPTER XI.

Of Love.

THE great intention of Nature, in endowing almoſt every animal with a ſexual attachment, is the multiplication and continuation of the reſpective ſpecies. But, with regard to man, and, in an inferior degree, to all pairing animals, love is the ſource of many other ſocial and important advantages. Love, or a ſtrong affection for a particular woman, is to young men, perhaps, one of the greateſt incentives to virtue and propriety of conduct. In northern countries, it ſeldom riſes to that degree of frenzy, which, in warmer climates, not only engroſſes the whole attention, but often totally unhinges the powers of the mind. In northern regions, however, it occupies more gently the imagination, gives a chearfulneſs and alacrity to the buſineſs or ſtudies of life, and, if reciprocal, diffuſes over the mind and body a placid happineſs, and a tranquillity of diſpoſition, which greatly contribute to the health and vigour of both. A young man in love thinks that the eyes of his favourite continually behold him. Through this amiable medium he views all his actions, and even his thoughts. His affection and veneration are ſo great, that he is, in ſome meaſure, deterred from regarding any other woman, and, what is of more importance, from indulging any looſe or irregular appetite. The diſpoſitions and affections of the female are the ſame with thoſe of the male. Her attention is completely engroſſed; and ſhe never thinks or dreams of any man, but of him who is the object of her affection. A young man and a young woman in love exhibit the moſt innocent and the moſt amiable picture of human nature. Actuated by no intereſted motives, and regardleſs of future contingencies, they obey the ſupreme command of Nature. How much is it to be lamented, that, from the cruel, but perhaps unavoidable inſtitutions and cuſtoms of civil ſocieties, it is ſo often not only prudent, but neceſſary, to check, and even to overcome, this powerful law of Nature?

Many are the advantages that mankind derive from ſociety and regular governments, and we ſhould chearfully ſubmit to thoſe hardſhips and inconveniencies to which they give riſe. But every man, however ſubmiſſive to the laws of his country, muſt regret that neceſſity which makes them oppoſe any of the laws of Nature, and eſpecially the almoſt irreſiſtible law of love.

In the preſent ſtate of ſociety, it muſt be acknowledged, early marriages, among people in the ordinary and dependent ranks of life, are extremely hazardous. When both parties are induſtrious and oeconomical, ſuch marriages are not only the moſt natural, but are productive of the greateſt happineſs and cordiality. But the reverſe is dreadful! Children, ſtraitened circumſtances, reſentment of parents, whether real or affected, too often produce all the complicated miſeries to which mankind, in their loweſt ſtate of degradation, can be ſubjected. Among this order of men, therefore, it is of the higheſt importance that the law of Nature ſhould yield, for ſome time at leaſt, to the inſtitutions of ſociety, and to thoſe prudential motives which parents learn from experience to be ingredients eſſential to the comfort and happineſs of life.

Men of fortune and of opulence have it in their power to obey the laws of Nature and of love; and ſome examples, though few in number, occaſionally happen of rich men acting a diſintereſted part in their matrimonial engagements. Inſtead of following the dictates of Nature, many men of fortune and independence, diſregarding the high privilege they enjoy, ſacrifice their taſte, their paſſion, and often their happineſs during life, at the ſhrine of Gold. To accompliſh this ſordid end, they often embrace deformity, diſeaſe, ignorance, peeviſhneſs, and every thing that is diſguſting to human nature. Let ſuch individuals ſuffer their puniſhment. But what are the conſequences to the public? Men of rank, in all nations and governments, not only regulate, in a great meaſure, the manners of their inferiors, but are the natural guardians of the ſtate. For theſe important purpoſes, their minds ſhould be noble, generous, and bold; and their bodies ſhould be ſtrong, maſculine, fit to encounter the fatigues of war, and to repel every hoſtile aſſault that may be made upon their country. But, when men of this deſcription, whatever be their motives, intermarry with weak, deformed, puny, or diſeaſed females, their progeny muſt of neceſſity degenerate. The ſtrength, beauty, and ſymmetry of their anceſtors are, perhaps, for ever loſt. What is ſtill more to be regretted, debility of body is almoſt univerſally accompanied with weakneſs of mind. Thus, by the avarice, ambition, or inattention, of one individual, a noble and generous race is completely deſtroyed. By reverſing this conduct, it is true, the breed may again be mended; but, to repair a ſingle breach, many generations, endowed with prudence and circumſpection, will be requiſite. A ſucceſſive degeneration, however, is an infallible conſequence of imprudent or intereſted marriages of this kind. One puny race may for ſome time be ſucceeded by another, till at laſt their conſtitutions become ſo feeble that the animals loſe the faculty of multiplying their ſpecies. This gradual degeneration is one great cauſe of the total extinction of conſpicuous and noble families. That it ſhould be ſo, is a wiſe and beneficent inſtitution of Nature; for, if ſuch debilitated races were continued, a univerſal degeneration would ſoon take place, and mankind would be unable to perform the duties, or to undergo the labours of life. Nature firſt chaſtiſes, and at laſt extirpates, all thoſe who act contrary to her eſtabliſhed laws.

Beſide the pleaſures reſulting from ſociety, and from mutual attachment in man, and in pairing animals, the natural love of offſpring is a ſource of the moſt engaging endearments. The innocence and helpleſs condition of infants call forth our pity and protection. When a little farther advanced, their beauty, their ſmiles, and their ſprightlineſs, excite the moſt agreeable emotions. In their progreſs from infancy to manhood, we obſerve with pleaſure the unfolding of their mental powers. They imitate our actions long before they can expreſs their deſires, or their wants, by language. Their attempts in the acquiſition of language are extremely curious and amuſing. Their firſt ſyſtem of grammar conſiſts entirely of ſubſtantive nouns. It is long before they learn the uſe of adjectives or of copulatives, and ſtill longer before they employ the verb. Their ſpeeches are ſhort, aukward, and blundering; but they are animated, and uttered with aſtoniſhing force and vivacity of expreſſion in their eyes, and in the geſtures of their bodies. At this period of life, children are ſolely actuated by Nature and imitation. After they acquire words ſufficient for conveying the few ideas they poſſeſs, they begin to reaſon, or rather to employ the language of reaſoning; for, at this period of life, children, when they mean to give a reaſon why they ſhould have any indulgence or gratification, almoſt univerſally argue againſt themſelves, and employ a reaſon why their deſires ſhould not be granted. This ridiculous mode of reaſoning excites laughter, and affords pleaſure and amuſement to the parents. It likewiſe ſhows, that our firſt attempt toward reaſoning is principally, if not ſolely, the effect of imitation; for the reaſoning power, at this period, is not fully unfolded, becauſe many human inſtincts, or mental qualities, have not yet been called forth into action. But here I muſt ſtop. To do juſtice to this intereſting ſubject would require volumes.

The love of offspring, which, though not univerſal, is perhaps the ſtrongeſt and moſt active principle in human nature. It overcomes the ſenſe of pain, and ſometimes even the principle of ſelf-preſervation. A remarkable and a melancholy example of the ſtrength of parental affection was lately exhibited, and, for the honour of our ſpecies, deſerves to be recorded. In the beginning of January 1786, the Halſewell Eaſt Indiaman, Captain Richard Pierce, was unfortunately wrecked on the coaſt of Dorſetſhire. Beſide ſeveral other ladies, Captain Pierce had two of his own daughters on board. When the ſhip was in the extremity of danger, ſome of the company, by ſwimming, and other feats of activity, got upon a rock. In this dreadful ſituation, Captain Pierce aſked Mr Rogers, his third mate, if any plan could be deviſed for ſaving the ladies? Mr Rogers replied, 'It is impoſſible! but you may ſave yourſelf.' Upon which the Captain, addreſſing himſelf to his daughters, and enfolding them in his arms, ſaid, 'Then, my dear children, we ſhall 'not part; we ſhall periſh together!' Mr Rogers quitted the ſhip and reached the rock: An univerſal ſhriek of deſpair was heard, in which the voices of female diſtreſs and horror were lamentably diſtinguiſhable. In a few moments all was huſhed; the ſhip, with every perſon on board, had then gone to the bottom. Parents chearfully ſubmit to the hardeſt labour, and expoſe themſelves to the greateſt dangers in order to procure nouriſhment to their young, or to protect them from injury.

A bitch, during the operation of diſſection, licked her young, whoſe preſence ſeemed to make her forget the moſt excruciating tortures; and, when they were removed, ſhe uttered the moſt dolorous cries. Certain ſpecies of ſpiders incloſe their eggs in a ſilken bag ſpun and wove by themſelves. This bag they fix to their back, and carry it along with them wherever they go. They are extremely nimble in their motions. But, when the bag is forced from a ſpider of this kind, her natural agility forſakes her, and ſhe falls into a languid ſtate. When the bag is again preſented to her, ſhe inſtantly ſeizes it, and carries it off with rapidity. The young ſpiders no ſooner eſcape from the eggs than they dexterouſly arrange themſelves on the back of the mother, who continues for ſome time to carry them about with her, and to ſupply all their wants. Another ſpecies of ſpider attaches her bag of eggs to her belly. This ſpider is likewiſe very agile, and ſo ferocious and determined in the protection of her eggs, that ſhe has been known to ſuffer death rather than relinquiſh them. The deer ſpontaneouſly preſents herſelf to be chaced by the dogs, to prevent them from attacking her fawn. When the fox perceives that her young have been diſturbed in her abſence, ſhe carries them off, one after another, and conceals them in a new retreat. Waſps feed their young, when in the worm or caterpillar ſtate, in the ſame manner as pigeons and other birds that diſgorge. The pigeon, after ſwallowing grain, retains it for ſome time in her ſtomach, till it is ſoftened and macerated: She then diſgorges, and throws it into the mouths of her young. 'In the ſame manner,' ſays Reaumur, 'I have obſerved a 'female waſp ſwallow a large portion of an inſect: In a ſhort time 'afterwards, ſhe traverſed the different cells of her neſt, diſgorged 'the contents of her ſtomach, and diſtributed food in this half digeſted form to her young worms *.'

All animals, man perhaps not excepted, acquire a double portion of force and courage after they bring forth. A cow, at leaſt in a domeſtic

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* Reaumur, tom. 11. pag. 230. 12mo edit.

domeſtic ſtate, is a placid and phlegmatic animal: But, whenever ſhe produces a calf, a wonderful change is exhibited: She inſtantly becomes vigilant, active, and even ferocious, in the defence of her young. A lioneſs deprived of her cubs preſents the moſt dreadful picture of anxiety, rage, and rapacity. Deſcending lower in the ſcale of animation, the ſame change is to be remarked. A domeſtic hen is a timid, indocile, and obſtinately ſtupid creature. Though chaced, harraſſed, and even put in danger of her life, fifty times in a day, ſhe never learns to avoid a garden, or any particular place which ſhe is accuſtomed to frequent, or to which ſhe is led by her appetite for food. But, the moment her chickens are hatched, inſtead of her uſual timidity, ſhe becomes as bold as a lion. When ſhe thinks her young are in danger, ſhe briſtles up her feathers, aſſumes a fierceneſs in her eye, makes an alarming noiſe, and attacks, in the moſt furious manner, and without diſtinction, every animal that comes near her. By the ſuddenneſs of her onſets, ſhe often alarms men, and actually intimidates and beats off dogs and other animals that could devour her in an inſtant.

Though ſeveral of the inſect tribes diſcover a ſtrong attachment to their young, yet all thoſe which undergo transformations, and do not form ſocieties, muſt be completely ignorant of the exiſtence of their progeny; becauſe, in general, the parents die before the young are hatched. Nature, however, has endowed thoſe ſpecies with an inſtinct which produces all the effects of parental affection: They uniformly depoſit their eggs in ſubſtances which afford to the young, immediately after their eſcape from the egg, a nouriſhment adapted to their reſpective conſtitutions, and a comfortable and ſafe protection from injury. Thus Nature, ever attentive to the continuation and happineſs of her productions, however ſeemingly inſignificant in the ſcale of being, often employs very different means to accompliſh the ſame beneficent purpoſes.

Nature has unqueſtionably attached pleaſure to all the neceſſary functions of animals. But this pleaſure cannot be conſidered as the original cauſe of any particular action; for the experiment muſt be made before the animal can diſcover whether the reſult is to be agreeable or diſagreeable. The truth is, that Nature has beſtowed on the minds of all animated creatures a number of laws or inſtincts perfectly accommodated to the ſpecies, and which irreſiſtibly compel them to perform certain actions. The effects of theſe laws we perceive: But the cauſes, or the modes by which they operate on animal minds, are inſcrutable. We may and muſt admire, but we can never penetrate the myſteries of Nature.

Bonnet, and ſome other naturaliſts, imagine they are exhibiting the cauſes of that ſtrong and mutual attachment between parents and their offspring, when they tell us, that, in man, and quadrupeds, and birds, the mother is fond of her young, becauſe their natural actions give riſe to agreeable ſenſations; that, from the ſtructure of the mammae, a gentle, but pleaſant ſenſation, is excited by the action of ſucking; that the mother is often incommoded by too great a quantity of milk, and that ſucking relieves her; that the young love their mother, becauſe ſhe feeds, protects, and communicates to them a cheriſhing warmth; that, among the feathered tribes, and particularly thoſe which ſit upon their young, by the gentle motions of the little ones, an agreeable ſenſation is excited in the belly of the mother, which is then frequently deprived of feathers. All theſe ſources of reciprocal pleaſure may be true: But ſtill they are only effects, and not original cauſes, of filial and parental affection; for that mutual attachment exiſts the moment after the young animals come into the world, and, of courſe, previous to all experience of titillation, of heat, of habit, or of any other circumſtances that may, perhaps, contribute to ſtrengthen or prolong the exertion of the primary cauſe, which muſt remain forever concealed from human penetration.

In moſt animals, except the human ſpecies, parental and filial affection ceaſe whenever the young are able to provide for themſelves. The pleaſures derived from ſucking, and from other circumſtances formerly mentioned, might for ſome time remain; but the young grow large, unwieldy, petulant, and enter into competitions for food, which not only contribute to alienate the affection of the parents, but even to excite reſentment and averſion. Theſe, however, are only ſecondary cauſes. The purpoſes of Nature are fulfilled. The ardour of affection, which was indiſpenſably neceſſary to the protection and rearing of the young, being now no longer uſeful, is ſo totally extinguiſhed, that neither the parents nor the offspring are capable of recognizing one another. This temporary and amiable inſtinct is obliterated, and never revives till the fervours of love are again felt, and a new progeny appear.

Marriage or pairing, though by no means an univerſal inſtitution of Nature, is not unfrequently exhibited in the animal creation. With regard to man, both male and female are inſtinctively impelled to make a ſelection. The force of this natural impulſe is ſtrongly felt by every young and uncorrupted individual. When not reſtrained by neceſſity, or other powerful motives, men and women would intermarry long before it would be prudent in civilized or artificial ſtates of ſociety. This univerſal, and almoſt irreſiſtible impulſe of ſelection, is to me the ſtrongeſt argument in favour of monogamy, or the union of pairs, among the human ſpecies.

The ſame impulſe, or law of Nature, takes place among many other animals, as the patridge tribes, the ſwallow, the linnet, and, in general, all the ſmall birds. The aſſiduity, attention, mutual affection, laborious vigilance, and ſteadfaſt fidelity of pairing animals, are truly admirable, and, to ingenuous minds, afford the moſt exemplary admonitions to virtue and conjugal attachment.

Beſide this forcible impulſe of ſelection implanted by Nature in man, and in every other pairing animal, ſome other facts deſerve to be noticed. In all pairing animals, including, of courſe, the human race, the males and females produced are nearly equal. This is a plain indication that Nature deſtined theſe animals to pair, or to marry. Injuſtice, jealouſy, animoſity, and every animal calamity, would enſue, if this order of Nature were encroached upon in creatures who are endowed with the inſtinct of ſexual ſelection.

It is not incurious to remark, that human inſtitutions often contradict the laws of Nature. The dunghill cock and hen, in a natural ſtate, pair. In a domeſtic ſtate, however, the cock is a jealous tyrant, and the hen a proſtitute. But, even in this unnatural ſociety, a ſelection is ſometimes to be obſerved. The ſame phenomenon is exhibited among mankind, when placed in certain ſituations. Like domeſtic poultry, the Turks, and ſome Aſiatic and African nations, influenced by an accurſed government, and by an execrable religion, rebel againſt the law of love, and of reciprocal attachment. In theſe countries, a rich man not only engroſſes, but impriſons and tortures, as many beautiful women as his fortune enables him to ſupport. Deſtitute of all thoſe endearments which ariſe from mental communication, from parental tenderneſs and affection, from mutual confidence and ſolace, he is, while young, perpetually tormented with jealous apprehenſions. As he advances in life, his jealouſy and his terror augment. Though his females are ſcrupulouſly guarded from every intruſion, by ſervile and mutilated wretches, his fears increaſe with his years and debility, till a premature and comfortleſs old age puts a period to his inſignificant and liſtleſs exiſtence.

In general, it is to be remarked, that all thoſe ſpecies of animals, whoſe offspring require, for ſome time, the induſtry and ſupport of both parents, are endowed with the inſtinct of ſelection, or of pairing. With regard to the feathered tribes, pairing is almoſt univerſal. A diſtinction, however, as to the duration and circumſtances of their pairing is to be obſerved. The young of all the ſmall birds, as well as of moſt of the larger kinds, continue for ſome weeks in a weak and helpleſs condition. The mother is not, like quadrupeds, provided with organs fitted to ſecrete milk; of courſe, ſhe is unable to nouriſh them out of her own body. She is therefore obliged to go abroad in queſt of food for them. But the progeny are ſo numerous, that all her induſtry, if not aſſiſted by the father, would be ineffectual for their ſupport and protection. In all birds whoſe young are in this condition, the males and females not only pair, but each of them is endowed with the ſtrongeſt parental affection. Both are equally anxious and induſtrious in procuring food for their mutual offspring. This parental care and attachment uniformly continues till the young are fledged, and have acquired ſufficient ſtrength to provide for themſelves. Eagles, and ſome other birds of prey, continue faithfully in pairs for years, and perhaps during life. Theſe facts afford a ſtrong argument in favour of marriage among mankind. No animal remains ſo long in the infant and helpleſs ſtate as the children of men; and no mother could, with her own induſtry, poſſibly ſuckle and procure nouriſhment for a numerous family. Here, as in the feathered tribes, the aſſiſtance of the father becomes indiſpenſable. On this ſubject, a curious inſtinct merits attention. The male of moſt birds not only ſelects a female, but, with great aſſiduity, brings food to her when ſitting on her eggs, and often relieves her, by ſitting on them himſelf.

There are other ſpecies of pairing birds, whoſe young, as ſoon as they are hatched, are capable of eating their food when preſented to them, and of courſe, require leſs labour from the parents. In theſe ſpecies, accordingly, the male pays no attention to the progeny, becauſe it is unneceſſary; but the mother carefully leads them about to places where proper food is to be had, protects them from injuries, and communicates heat to them by covering them with her wings.

Quadrupeds, eſpecially thoſe which feed upon graſs, do not pair; becauſe, while the female gives ſuck to her young, ſhe herſelf is feeding. Beſide, the young of this tribe, very ſoon after birth, can eat graſs and other vegetables. The Count de Buffon remarks, that the roe-deer, though they feed upon graſs, are to be excepted from this rule; for they pair, and have annually but one litter. Lions, tigers, wolves, and other rapacious quadrupeds, do not pair. The whole labour of procuring food is devolved upon the female, which often ſhortens her own life, as well as that of her offspring. In relation to man, this is a fortunate circumſtance; for, if beaſts of prey paired, a dangerous multiplication of thoſe deſtructive ſpecies would be the conſequence. But pairing is eſſentially neceſſary to birds of prey; becauſe, during the proceſs of incubation, the female would not have time ſufficient for procuring food; which, in theſe animals, requires both patience and addreſs. Some quadrupeds, particularly thoſe which lay up proviſions for the winter, as the beaver, pair. As ſoon as the young beavers are produced, the males abandon the ſtock of proviſions to the females, and go in queſt of food for themſelves. But they by no means relinquiſh their mates; but frequently return and viſit them while they are ſuckling their young.

If man, and ſome of the pairing animals be excepted, the ſeaſons of love are limited to particular times of the year. Theſe ſeaſons, though various, are admirably adapted to the nature and oeconomy of the different ſpecies. In all animals of this kind, the ſeaſons of love, and the times of female geſtation, are ſo contrived by Nature, that the offspring, when brought forth, are amply ſupplied with the particular ſpecies of food upon which they principally live. Though the times of geſtation vary conſiderably among ſuch quadrupeds as feed upon graſs, the reſpective females uniformly bring forth early in ſummer, when the graſs is tender and luxuriant. The mare comes in ſeaſon in ſummer, carries eleven months, and is delivered in the beginning of May. Sheep and goats come in ſeaſon in the end of October or beginning of November. They carry five months, and produce when the graſs begins to ſpring. It is worthy of obſervation, that, though the times of geſtation in the ſame ſpecies, and in all latitudes, never alter, yet the ſeaſons of love, and times of delivery, vary with the climate. In Italy, ſheep come in ſeaſon in the months of June or July. The females, as uſual, carry five months, and bring forth in November or December, the very period when graſs, in that climate, is in its beſt ſtate for paſture; for, in April, it is burnt up, and ſheep have nothing to browſe upon but ſhrubs. The rutting ſeaſon of the ſtag is in the end of September and beginning of October, and the female brings forth in May or the beginning of June. Theſe animals inhabit the higheſt mountains of Scotland, where the graſs, of courſe, does not begin to ſpring ſo early as in the lower parts of that country. Beavers come in ſeaſon about the end of autumn, and bring forth in January, when their ſtore-houſes are full of proviſions. The young of pairing birds are produced in the ſpring, when the weather begins to be comfortably warm, and their natural food abounds. In a word, the bringing forth, or hatching, of all animals, not excluding the inſect tribes, uniformly takes place at thoſe ſeaſons of the year when the nature of the weather, and the food peculiar to the ſpecies, are beſt adapted to the conſtitution of their offſpring. Caterpillars of every kind are never hatched till the various plants on which they feed, though they grow in different months, have put forth their leaves.

We ſhall conclude this ſubject, by giving a Table of the Relative Fecundity, &c. of Animals, which, in a ſhort compaſs, ſolves a number of queſtions with regard to the natural hiſtory of quadrupeds. It is taken from the eighth volume of the Tranſlation of Buffon, to whoſe authority moſt readers will be inclined to give great weight.

TABLE

TABLE of the RELATIVE FECUNDITY of ANIMALS.

Names.	Age at which Males can engender, and Females produce.		Times of geſtation.	Number of young produced at a litter.	Age at which Males ceaſe to engender, and Females to produce.	
	MALE. Years.	FEMALE. Years.			MALE. Years.	FEMALE. Years.
Elephant	30	30	2 years	1 in three or four years	lives 200	
Rhinoceros	15 or 20	15 or 20		1	lives 70 or 80	
Hippopotamus				1		
Walrus			9 months	1		
Camel	4	4	1 year nearly	1	lives 40 or 50	
Dromedary	4	4	idem	1	lives 40 or 50	
Horſe	2½	2	11 months	1, ſometimes 2	at 25 or 30	at 18 or 20
Zebra	2	2	11 ditto	1, rarely 2	at 25 or 30	at 18 or 20
Aſs	2	2	11 ditto & more	1, rarely 2	at 25 or 30	at 25 or 30
Buffalo	3	3	9 months	1	lives 15 or 18	
Ox	2	1½	9 ditto	1, rarely 2	at 9	at 9
Stag	1½	1½	8 ditto & more	1, rarely 2	lives 30 or 35	
Rain-deer	2	2	8 months	1	lives 16	
Lama	3	3		1, rarely 2	at 12	at 12
Man	14	12	9 months	1, ſometimes 2		
Large Apes	3	3		1, ſometimes 2		
Mouflon	1½	1	5 ditto	1, ſometimes 2 twice a year in hot climates	at 8	at 10 or 12
Saiga	1	1	5 ditto	1, ſometimes 2	lives 15 or 20	
Roebuck	1½	2	5 ditto	1, 2, ſometimes 3	lives 12 or 15	
Chamois Goat	1	1	5 ditto	1, 2, rarely 3	lives 20	
Goat	1	7 months	5 ditto	1, 2, rarely 3, and never above 4	at 7	at 7
Sheep	1	1	5 ditto	1, ſometimes 2, twice a year in warm climates	at 8	at 10 or 12

Names.	Age at which Males can engender, and Females produce. MALE. Years.	FEMALE. Years.	Times of geſtation.	Number of young produced at a litter.	Age at which Males ceaſe to engender, and Females to produce. MALE. Years.	FEMALE. Years.
Seal			ſeveral months	2 or 3		
Bear	2	2	ditto	1, 2, 3, 4, and never above 5	lives 20 or 25	
Badger				3 or 4		
Lion	2	2		3 or 4 once a year	lives 20 or 25	
Leopard and Tiger	2	2		4 or 5 once a year		
Wolf	2	2	73 days or more	5, 6, to 9, once a year	at 15 or 20	at 15 or 20
Dog in a natural ſtate	9 or 10 months	9 or 10 months	63 days	3, 4, 5, 6	at 15	at 15
Iſatis			63 days	6 and 7		
Fox	1	1	In ſeaſon in winter, and produces in April	3, 4, to 6	at 10 or 11	at 10 or 11
Jackal				2, 3, or 4		
Cat in a natural ſtate	before 1	before 1	56 days	4, 5, or 6	at 9	at 9
Martin	1	1	56 days, it is ſaid	3, 4, and 6	at 8 or 10	at 8 or 10
Pine Weaſel	1	1	idem	3, 4, and 6	at 8 or 10	at 8 or 10
Polecat	1	1	idem	3, 4, and 5	gener. during life	prod. during life
Weaſel	1ſt year	1ſt year		3, 4, and 5	idem	idem
Ermine	idem	idem		idem	idem	idem
Squirrel	1	1	copulates in March, and produces in May	3 or 4	idem	idem
Flying Squirrel				3 or 4		
Hedgehog	1	1	40 days	3, 4, and 5		
Dormice	1ſt year	1ſt year		3, 4, and 5	lives 6	
Muſk Rats				4, 5, or 6		

Names.	Age at which Males can engender, and Females produce.		Times of geſtation.	Number of young produced at a litter.	Age at which Males ceaſe to engender, and Females to produce.	
	MALE. Years.	FEMALE. Years.			MALE. Years.	FEMALE. Years.
Opoſſums				4, 5, 6, and 7		
Hogs	1 year or 9 mos.	1 year or 9 mos.	4 months	10, 12, 15, to 20, twice a year	at 15	at 15
Armadillos				4 ſeveral times a year		
Hare	1ſt year	1ſt year	30 or 31 days	2, 3, 4, ſeveral times a year	lives 7 or 8	
Rabbit	5 or 6 months	5 or 6 months	idem	4, 5, to 8, ſeveral times a year	idem	
Ferret	1ſt year	1ſt year	40 days	5, 6, to 9, twice a year	during life	
Rats	idem	idem	5 or 6 weeks	5 or 6 ſeveral times a year	idem	
Field Mice	idem	idem	1 month, or 5 weeks	9 or 10 ſeveral times a year		
Mouſe	idem	idem	idem	5 or 6 ſeveral times a year	idem	
Brown Rat	idem	idem		12 to 19 thrice a year	idem	
Guinea Pig	5 or 6 weeks	5 or 6 weeks	3 weeks	eight times a year; 1ſt litter, 4 or 5; 2d, 5 or 6; and the others, 7, 8, to 11	lives 6 or 7, and produces during life	

CHAPTER XII.

Of the Transformation of Animals.

THE transformation of caterpillars, and of different kinds of worms, into winged inſects, has long excited the attention, as well as the admiration of mankind. But the truth is, that every animal, without exception, undergoes changes in their ſtructure, mode of exiſtence, and external appearances. Mankind, from their embryo ſtate, to their final diſſolution, aſſume many different forms. Some weeks after conception, the rudiments of a human being are to be perceived. As pregnancy advances, the approaches to the perfect figure become gradually more diſtinguiſhable, till the period of birth. While in the foetus ſtate, the head is diſproportionally large, when compared with the other parts of the body; nouriſhment is conveyed to it by very different channels; and reſpiration is not neceſſary, becauſe the circulation of the blood is not carried on in the ſame manner as after birth. Even after birth, the form, ſymmetry, and organs of the animal are by no means complete. The head continues for ſome time to be diſproportionally large; the hands and feet are not properly ſhaped; the legs are crooked; the hair on the head is ſhort and ſcanty; no teeth as yet appear; and there is not a veſtige of a beard. In a few months, however, the ſymmetry of all the parts is evidently improved, and the teeth begin to ſhoot. The growth of the whole body, as well as the ſtrength and beauty of its form, gradually advance to perfection till the ſixth or ſeventh year, when another change takes place. At this period, the firſt ſet of teeth are ſhed, and are replaced by new ones. From boyhood to puberty, the ſize of the body, and of its different members, increaſe. When the age of puberty arrives, ſeveral important changes are produced in the ſyſtem of both males and females. The beard now makes its appearance; the dimenſions of the body, in moſt individuals, are ſuddenly augmented; and both ſexes become capable of multiplying the ſpecies. From this period, to the age of twenty-five or thirty, the muſcles ſwell, their interſtices are filled with fat, the parts bear a proper proportion to each other, and man may now be conſidered as a perfect animal. In this ſtate of bodily perfection and vigour, he generally remains till he reaches his fiftieth year. Then a new but a gradual change begins to appear. From the fiftieth year to the age of ſeventy or eighty, the powers of the body decline in their ſtrength and activity. The muſcles loſe their ſpring and their force. The vigour of manhood is no longer felt; and the withered decrepitude of old age is ſucceeded by death, its unavoidable conſequence.

The mind of man undergoes changes as well as his body. The taſte, the appetites, and the diſpoſitions, are in perpetual fluctuation. How different is the taſte of a child from that of a man? Fond of gewgaws and of trifling amuſements, children frolic away their time without much thought or reflection. When advancing toward puberty, their diſpoſitions and deſires ſuffer a gradual mutation. New inſtincts are unfolded, and a ſenſe of propriety begins to be perceived. They deſpiſe their former occupations and amuſements; and different ſpecies of objects ſollicit and obtain their attention. Their powers of reflection are now conſiderably augmented; and both ſexes acquire a modeſty and a ſhyneſs with regard to each other. This aukward, but natural baſhfulneſs, by the intercourſe of ſociety, as well as by the impulſes of Nature, vaniſhes ſoon after puberty, when the ſtate of manhood and of gallantry commences. From this period, to the age of twenty-five or thirty, men's minds aſſume a bold, enterpriſing, and active tone. They engage in the buſineſs of life, look forward to futurity, and have a deſire of marrying, and of eſtabliſhing families. All the ſocial appetites are in vigour; ſolid and manly friendſhips are formed; and man goes on for ſome time to enjoy every kind of happineſs which his nature is capable of affording. I wiſh the next change had no exiſtence. At fifty or ſixty, the mental powers, in general, like thoſe of the body, begin to decline, till feeble and tremulous old age arrives, and death cloſes the mutable ſcene of human life.

With regard to *quadrupeds*, both before and after birth, they undergo ſimilar, and many of them greater, changes of form than thoſe of the human ſpecies. Their mental powers, likewiſe, their diſpoſitions and manners, as well as the objects of their attention, vary according to the different ſtages of their exiſtence. Many of them come into the world blind, and continue for ſome time before they receive the ſenſe of ſeeing. How many changes are exhibited in the dog from birth till he becomes a perfect animal, till all his members are completely formed, and all his inſtincts are unfolded and improved by experience and education? The deer-kind acquire not their magnificent and beautiful horns before the age of puberty; and even theſe are annually caſt off and renewed. Similar changes take place in quadrupeds of every denomination; with examples of which every man's experience and recollection will readily ſupply him; and, therefore, it is unneceſſary to be more particular.

Neither are *Birds*, in their progreſs from birth to maturity, exempted from changes. Like quadrupeds, many birds are blind for ſome time after they are hatched. In this condition, how different are their form and appearances from thoſe of the perfect animals! At firſt, they are covered with a kind of down inſtead of feathers. Even after the feathers ſhoot, they are often of a colour different from that which they acquire when full grown. The beautifully variegated colours of the peacock's tail appear not till he arrives at his third year *. Birds that have creſts, or wattles, live a conſiderable time before they acquire theſe ornaments, or marks of diſtinction. All birds annually molt, or caſt their feathers, in the ſame manner as quadrupeds ſhed their hair, the new puſhing out the old.

Frogs, and many other *amphibious* animals, undergo great changes in their form and ſtructure. When it firſt eſcapes from the egg, a frog appears in the form of a tadpole, an animal with a large roundiſh head, and a compreſſed or flat tail, but totally deſtitute of feet and legs. In this ſtate it remains a conſiderable time, when the two fore-feet begin to ſhoot, and have an exact reſemblance to the buds of trees. As their growth advances, the toes and legs are diſtinguiſhable. The ſame proceſs goes on with the hind-legs, only they are ſomewhat later in making their appearance. During the growth of the legs, the blood being drawn into different channels, the tail ſuffers a gradual mortification, till at laſt it totally vaniſhes, and the tadpole is metamorphoſed into a quadruped. Tadpoles never come out of the water; but, after their transformation into frogs, they become amphibious, and occaſionally frequent both land and water.

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* Linnaei Amoen. Acad. vol. 4. p. 368.

The *cruſtaceous* tribes, as lobſters, crabs, &c. beſide the different appearances they aſſume while growing to perfection, caſt their ſhells every year. When this change is about to happen, they retire into the crevices of rocks, or ſhelter themſelves below detached ſtones, with a view to conceal and defend their bodies from the rapacious attacks of other fiſhes. After the ſhells are caſt, the animals are exceedingly weak and defenceleſs. Inſtead of their natural defence of hard ſhells, and ſtrong claws, they are covered only with a thin membrane or ſkin. In this ſtate they become an eaſy prey to almoſt every fiſh that ſwims. The ſkin, however, gradually thickens and grows harder, till it acquires the uſual degree of firmneſs. By this time the animals have reſumed their former ſtrength and activity; they come out from their retirements, and go about in queſt of food.

Serpents, and many other *reptiles*, caſt their ſkins annually. The beauty and luſtre of their colours are then highly augmented. Before caſting, the old ſkins have a tarniſhed and withered appearance. The old ſkins, like the firſt ſet of teeth in children, are forced off by the growth of the new.

We come now to give ſome account of the transformations of *inſects*, which are both various and wonderful. All winged inſects, without exception, and many of thoſe which are deſtitute of wings, muſt paſs through ſeveral changes before the animals arrive at the perfection of their natures. The appearance, the ſtructure, and the organs of a caterpillar, of a chryſalis, and of a fly, are ſo different, that, to a perſon unacquainted with their transformations, an identical animal would be conſidered as three diſtinct ſpecies. Without the aid of experience, who could believe that a butterfly, adorned with four beautiful wings, furniſhed with a long ſpiral proboſcis or tongue, inſtead of a mouth, and with ſix legs, ſhould have proceeded from a diſguſting, hairy caterpillar, provided with jaws and teeth, and fourteen feet? Without experience, who could imagine that a long, white, ſmooth, ſoft worm, hid under the earth, ſhould be tranſformed into a black, cruſtaceous beetle, having wings covered with horny elytra, or caſes?

Upon this branch of the ſubject, we ſhall, *firſt*, give an example or two of the moſt common transformations of Inſects; and, *ſecondly*, deſcribe ſome of the more uncommon kinds.

Beſide their final metamorphoſis into flies, caterpillars undergo ſeveral intermediate changes. All caterpillars caſt or change their ſkins oftener or more ſeldom, according to the ſpecies. Malpighius informs us, that the ſilk-worm, previous to its chryſalis ſtate, caſts its ſkin four times. The firſt ſkin is caſt on the 10th, 11th, or 12th day, according to the nature of the ſeaſon; the ſecond in five or ſix days after; the third in five or ſix days more; and the fourth and laſt in ſix or ſeven days after the third. This changing of ſkin is not only common to all caterpillars, but to every inſect whatever. Not one of them arrives at perfection without caſting its ſkin at leaſt once or twice. The ſkin, after it is caſt, preſerves ſo entirely the figure of the caterpillar in its head, teeth, legs, colour, hair, &c. that it is often miſtaken for the animal itſelf. A day or two before this change happens, caterpillars take no food: They loſe their former activity, attach themſelves to a particular place, and bend their bodies in various directions, till at laſt they eſcape from the old ſkin, and leave it behind them. The inteſtinal canal of caterpillars is compoſed of two principal tubes, the one inſerted into the other. The external tube is compact and fleſhy; but the internal one is thin and tranſparent. Some days before caterpillars change into the chryſalis ſtate, they void, along with their excrement, the inner tube which lined their ſtomach and inteſtines. When about to paſs into the chryſalis ſtate, which is a ſtate of imbecillity, caterpillars ſelect the moſt proper places and modes of concealing themſelves from their enemies. Some, as the ſilk-worm, and many others, ſpin ſilken webs or cods round their bodies, which completely diſguiſe the animal form. Others leave the plants upon which they formerly fed, and hide themſelves in little cells which they make in the earth. The rat-tailed worm abandons the water upon the approach of its metamorphoſis, retires under the earth, where it is changed into a chryſalis, and, after a certain time, burſts from its ſeemingly inanimate condition, and appears in the form of a winged inſect. Thus the ſame animals paſs the firſt and longeſt period of their exiſtence in the water, another under the earth, and the third and laſt in the air. Some caterpillars, when about to change into a chryſalis ſtate, cover their bodies with a mixture of earth and of ſilk, and conceal themſelves in the looſe ſoil. Others incruſt themſelves with a ſilky or glutinous matter, which they puſh out from their mouths, without ſpinning it into threads. Others retire into the holes of walls or of decayed trees. Others ſuſpend themſelves to the twigs of trees, or to other elevated bodies, with their heads undermoſt. Some attach themſelves to walls, with their heads higher than their bodies, but in various inclinations; and others chooſe a horizontal poſition. Some fix themſelves by a gluten, and ſpin a rope round their middle to prevent them from falling. Thoſe which feed upon trees attach themſelves to the branches, inſtead of the leaves, which are leſs durable, and ſubject to a greater variety of accidents. The colours of the caterpillars give no idea of thoſe of the future flies.

In general, the figure of chryſalids approaches to that of a cone, eſpecially in their poſterior part. When under this form, the inſect ſeems to have neither legs nor wings. It is incapable either of walking or of crawling. It takes no nouriſhment, becauſe it has no organs ſuited to that purpoſe; yet, in ſome ſpecies, life is continued for ſeveral months before their laſt metamorphoſis takes place. In a word, it ſeems to be a lifeleſs maſs. But, upon a more attentive obſervation, it poſſeſſes the power of bending upwards and downwards the poſterior part of its body. The ſkin, or exterior covering, of thoſe which do not ſpin cods, ſeems to be of a cartilaginous nature. It is commonly ſmooth and ſhining. In ſome ſpecies, however, the ſkin of the chryſalis is more or leſs covered with hair, and other rugoſities. Though chryſalids differ both in figure and colour, their appearances are by no means ſo various as thoſe of the caterpillars from which they are produced. The colour of ſome chryſalids is that of pure gold, from which circumſtance the whole have received their denomination. For the ſame reaſon they are called *aureliae* in Latin. Some are brown, others green; and, indeed, they are to be found of almoſt every colour and ſhade.

The life of winged inſects conſiſts of three principal periods, which preſent very different ſcenes to the ſtudent of Nature. In the firſt period, the inſect appears under the form of a *worm* or *caterpillar*. Its body is long, cylindrical, and conſiſts of a ſucceſſion of rings, which are generally membranous, and encaſed within each other. By the aid of its rings, or of crotchets, or of ſeveral pairs of legs, it crawls about in queſt of food; and its movements are, in ſome ſpecies, remarkably quick. Its head is armed with teeth, or pincers, by which it eats the leaves of plants or other kinds of food. In this ſtate, it is abſolutely deprived of ſex, and, conſequently, of the power of multiplication. Its blood moves from the tail toward the head. It reſpires either by ſtigmata or ſmall apertures placed on each ſide of its body, or by one or ſeveral tubes ſituated on its poſterior part, which have the reſemblance of ſo many tails. In the ſecond period, the inſect appears under the form of a nymph, or that of a chryſalis. When an inſect, after throwing off the ſkin of the caterpillar, exhibits all its external parts, only covered with ſoft and tranſparent membranes, it is called a *nymph*. But, when to theſe membranes is added a common and cruſtaceous covering, it receives the name of a *chryſalis*. While in the ſtate of a nymph, or that of a chryſalis, inſects, in general, are totally inactive, and ſeem not to poſſeſs any powers of life. Sunk into a kind of deep ſleep, they are little affected with external objects. They can make no uſe of their eyes, their mouth, or any of their members; for they are all impriſoned by coverings more or leſs ſtrong. No cares occupy their attention. Deprived of the faculty of motion, they remain fixed in thoſe ſituations which they have choſen for their temporary abode, or where chance has placed them, till their final metamorphoſis into flies. Some of them, however, are capable of changing place; but their movements are ſlow and painful. Their blood circulates, but in a contrary direction from what takes place in the caterpillar ſtate; for it proceeds from the head toward the tail. Reſpiration continues to go on, but the organs are differently ſituated. In the caterpillar, the principal organs of reſpiration were placed at the poſterior part of the body; but now theſe ſame organs are to be found at the anterior part of the animal. In the third period, the inſect has acquired that perfect organization which correſponds to the rank it is to hold in the ſcale of animation. The bonds of the nymph, or of the chryſalis, are now burſt aſunder, and the inſect commences a new mode of exiſtence. All its members, formerly ſoft, inactive, and folded up in an envelope, are expanded, ſtrengthened, and expoſed to obſervation. Under the form of a worm or caterpillar, it crawled; under thoſe of a nymph, or chryſalis, its power of motion was almoſt annihilated; under the laſt form, it is furniſhed with ſix ſpringy legs, and two or four wings with which it is enabled to fly through the air. Inſtead of teeth or pincers, with which it divided a groſs aliment, it has now a trunk by which it extracts the refined juices of the moſt delicate flowers. Inſtead of a few ſmooth eyes which it poſſeſſed in the worm or caterpillar ſtate, the new inſect is furniſhed with both ſmooth and convex eyes, to the number of ſeveral thouſands.

The internal parts of the inſect have likewiſe undergone as many changes as the external. The texture, the proportions, and the number of the viſcera, are greatly altered. Some have acquired an additional degree of conſiſtence; others, on the contrary, are rendered finer and more delicate. Some receive a new form, and others are entirely annihilated. Laſtly, ſome organs in the perfect inſect, which ſeemed formerly to have no exiſtence, are unfolded, and become viſible. The moſt important of this laſt kind are the organs of generation. The caterpillar, the nymph, and the chryſalis, were of no ſex. But, after transformation, both ſexes are diſtinguiſhable, and the animals are capable of multiplying their ſpecies.

We ſhall now give ſome examples of transformations which deviate from the common mode.

Some inſects hold a middle rank between thoſe which preſerve their original figure during life, and thoſe that ſuffer transformations. Their exiſtence is divided into two periods only. They walk in the firſt, and fly in the ſecond. Thus their only metamorphoſis conſiſts of the addition of wings, the growth and expanſion of which are performed without any conſiderable alteration in the figure of their bodies.

There is not a law eſtabliſhed among organized bodies which ſeems to be ſo univerſal, as that all of them grow, or augment in ſize, after birth, till they arrive at maturity. If a hen were to bring forth an egg as large as her own body, and if this egg, when hatched, were to produce a bird of equal dimenſions with either of the parents, it would be conſidered as a miracle. But the *ſpider-fly*, ſo denominated from its figure, affords an example of a ſimilar prodigy. This fly actually lays an egg, from which a new fly is hatched that is as large and as perfect as its mother. This egg is roundiſh, is at firſt white, and afterwards aſſumes a ſhining black colour. Upon a more accurate examination, however, this production was found to be an egg only in appearance. When the envelope is removed, inſtead of a gelatinous ſubſtance, the new inſect, furniſhed with all its members, is diſcovered. But this diſcovery does not render the fact the leſs wonderful. All winged inſects undergo their different transformations after being expelled from the bodies of their mothers, and receive great augmentations of ſize before their metamorphoſis into the nymph or chryſalis ſtate, after which their growth ſtops. But the ſpider-fly affords an inſtance of an inſect transformed in the belly of its mother, and which grows no more after it eſcapes from its envelope. This fact is fully authenticated by Reaumur *, Bonnet †, and other naturaliſts.

The worm from which the tipula or crane-fly is produced is perfectly ſmooth. Immediately before its firſt transformation it retires under ground. After this metamorphoſis, the ſurface of the nymph is furniſhed with a number of prickles. By means of theſe prickles, the nymph, when about to be transformed into a fly, raiſes itſelf in its hole till the cheſt of the inſect is above ground. The fly then burſts its priſon, mounts into the air, and leaves its former covering behind in the earth.

Many ſpecies of flies depoſit their eggs in the leaves and different parts of plants. Soon after the egg is inſerted into the leaf, a ſmall tubercle begins to appear, which gradually increaſes in magnitude till

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* Reaumur, vol. 12. p. 412. edit. 12mo.

† Oeuvres de Bonnet, vol. 4. p. 28. edit. 8vo.

till the animal is hatched, and has paſſed through its different tranſformations. Theſe tubercles are known by the name of *galls*, and are very different in their form, texture, colour, and ſize. Galls of every kind, however, derive their origin from the ſtings of inſects, which generally belong to the claſs of flies. The female fly, by means of her ſting, makes inciſions in the leaves or branches of a tree, and in each inciſion ſhe lays an egg. This egg is at firſt extremely minute; but it ſoon acquires a conſiderable bulk, and the gall has arrived at its full ſize before the worm is hatched. This gall ſeems to be analogous to the membranes which inveſt a foetus, and expand in all directions in proportion to its growth. That the eggs of oviparous animals grow while in the ovarium is univerſally known; but it is ſingular that the eggs of gall-flies ſhould grow after being ſeparated from the body of the mother. Theſe eggs muſt undoubtedly be furniſhed with external veſſels, or a kind of roots, by which they extract juices from the internal cavity of the gall. Malpighius aſcribes the origin of galls to a corroſive liquor introduced by the fly into the wound. But Reaumur, to account for the growth of a gall, thinks it unneceſſary to have recourſe to any ſuppoſed poiſonous fluids, and attributes it to the ſuperabundant nutricious] juices derived to that particular part by the continual action of the abſorbent veſſels of the egg, joined to its heat, which may be compared to a little fire placed in the center of the tumour.

Whether theſe cauſes are ſufficient to explain the growth of galls, we ſhall ſubmit to the judgment of the reader. But, that the eggs depoſited by the flies augment in ſize; that worms proceed from them; that theſe worms are nouriſhed, and live a certain time impriſoned in the galls; that they are there transformed into nymphs or chryſalids; and, laſtly, that they are metamorphoſed into winged inſects, which, by gnawing an aperture through the gall, take their flight in the air; are known and inconteſtible facts, of the truth of which every man may eaſily ſatisfy himſelf. Examine the common oak-galls, or thoſe of any other tree; if any of them happen to have no aperture, cut them gently open, and you are certain to find an egg, a worm, a chryſalis, or a fly: But in ſuch as are perforated by a cylindrical hole, not a veſtige of an animal is diſcoverable. The galls which make an ingredient in the compoſition of ink are thick, and their texture is very ſtrong and compact: That the ſmall animals they contain ſhould be able to pierce through ſuch a rigid ſubſtance is truly wonderful.

In the general order of Nature among oviparous animals, each egg includes one embryo only. A ſingular ſpecies of eggs, however, diſcovered by the celebrated Mr Folks, late Preſident of the Royal Society of London, muſt be excepted. He found great numbers of them in the mud of ſmall rivulets. In ſize they equalled the head of an ordinary pin. They were of a brown colour, and their ſurface was cruſtaceous, through which, by employing the microſcope, ſeveral living worms were diſtinctly perceptible. By dexterouſly breaking the ſhell, he diſlodged them; and he found with ſurpriſe, that eight or nine worms were contained in, and proceeded from, the ſame egg. They were all well formed, and moved about with great agility. Each of them was incloſed in an individual membranous covering, which was extremely thin and tranſparent. It were to be wiſhed that the transformations of theſe extraordinary animals had been traced.

Some caterpillars, when about to transform, make a belt paſs round their bodies. This belt is compoſed of an aſſemblage of ſilken threads ſpun by themſelves, the ends of which they paſte to the twigs of buſhes, or other places where they chooſe to attach their bodies. They likewiſe fix their hind legs in a tuft of ſilk. After transformation, the chryſalids remain fixed in the ſame manner as before their metamorphoſis. The belt is looſe, and allows the chryſalis to perform its ſlow and feeble movements.

The whole moth-kind, as well as the ſilk-worm, immediately before their transformation into the chryſalis ſtate, cover their bodies with a cod or clue of ſilk, though the nature of the ſilk, and their mode of ſpinning, are very different. The cods of the ſilk-worm are compoſed of pure ſilk. Their figure is generally oval, which neceſſarily reſults from that of the animal's body upon which they are moulded. When ſpinning, they twiſt their bodies into the form of an S. The cod is produced by numberleſs circumvolutions and zigzags of the ſame thread. The ſilk is ſpun by an inſtrument ſituated near the mouth of the inſect. The ſilky matter, before it is manufactured by the ſpinning inſtrument, appears under the form of a gum almoſt liquid, which is contained in two large reſervoirs contorted like the inteſtines of larger animals, and which terminate at the ſpinning inſtrument by two parallel and ſlender conduits. Each conduit furniſhes matter for one thread. The ſpinning inſtrument, as is evident when viewed by the microſcope, unites the two threads into one. Thus a thread of ſilk, which has the appearance of being ſingle, is in reality double, and ſpun with great dexterity. Some writers, who delight in the marvellous, aſcribe foreſight to the ſilk-worm in ſpinning its cod. The ſilk-worm, it muſt be acknowledged, acts as if it foreſaw the approaching event. But the truth is, that, when the animal has acquired its full growth, its reſervoirs of ſilk are completely filled. It then ſeems to be ſtrongly ſtimulated to evacuate this glutinous matter. Its different movements and attitudes, while diſcharging the ſilk, produce thoſe oval bundles which clothe and ornament vaſt numbers of the human ſpecies.

Another ſpecies of caterpillar conſtructs its cod in the form of a boat with the keel uppermoſt; but it conſiſts not entirely of pure ſilk. The animal, with its teeth, detaches ſmall triangular pieces of bark from a buſh or a tree. Theſe pieces of bark it paſtes upon its body by means of a glutinous or ſilky ſubſtance, and they conſtitute a principal part of its cod.

Another ſpecies works alſo in wood, though not with equal art as the former. Its cod is compoſed entirely of ſmall irregular fragments of dried wood. Theſe fragments the animal has the addreſs to unite together, and to form of them a kind of box which covers and defends its whole body. It accompliſhes this purpoſe by moiſtening, for ſome moments, the pieces of wood in its mouth, and then attaches them to each other by a glutinous ſubſtance. Of this mixture the caterpillar forms a cod, the ſolidity of which is nearly equal to that of wood.

The moſt ſolitary of all inſects are thoſe who live in the internal parts of fruits. Many of them undergo their metamorphoſis in the fruit itſelf, which affords them both nouriſhment and a ſafe retreat. They dig cavities in the fruit, which ſome of them either line with ſilk, or ſpin cods. Others leave the fruit, and retire to be transformed in the earth.

The metamorphoſis of inſects has been regarded as a ſudden operation, becauſe they often burſt their ſhell or ſilky covering quickly, and immediately appear furniſhed with wings. But, by more attentive obſervation, it has been diſcovered that the transformation of caterpillars is a gradual proceſs from the moment the animals are hatched till they arrive at a ſtate of perfection. Why, it may be aſked, do caterpillars ſo frequently caſt their ſkins? The new ſkin, and other organs, were lodged under the old ones, as in ſo many tubes or caſes, and the animal retires from theſe caſes, becauſe they have become too ſtrait. The reality of theſe encaſements has been demonſtrated by a ſimple experiment. When about to molt or caſt its ſkin, if the foremoſt legs of a caterpillar are cut off, the animal comes out of the old ſkin deprived of theſe legs. From this fact, Reaumur conjectured, that the chryſalis might be thus encaſed, and concealed under the laſt ſkin of the caterpillar. He diſcovered that the chryſalis, or rather the butterfly itſelf, was incloſed in the body of the caterpillar. The proboſcis, the antennae, the limbs, and the wings, of the fly are ſo nicely folded up, that they occupy a ſmall ſpace only under the two firſt rings of the caterpillar. In the firſt ſix limbs of the caterpillar are encaſed the ſix limbs of the butterfly. Even the eggs of the butterfly have been diſcovered in the caterpillar long before its transformation.

From theſe facts it appears, that the transformation of inſects is only the throwing off external and temporary coverings, and not an alteration of the original form. Caterpillars may be conſidered as analogous to the foetuſes of men and of quadrupeds. They live and receive nouriſhment in envelopes till they acquire ſuch a degree of perfection as enables them to ſupport the ſituation to which they are ultimately deſtined by Nature.

One would not readily believe that the *excrements* of a butterfly ſhould be capable of exciting conſternation in the minds of the people. But this event has frequently happened in different places and nations. Among many other prodigies which have terrified nations, *ſhowers of blood* have been enumerated by hiſtorians. Theſe ſhowers of blood were ſuppoſed to portend great and calamitous events, as wars, the deſtruction of cities, and the overthrow of empires. About the beginning of July, in the year 1608, one of theſe pretended ſhowers of blood fell in the ſuburbs of Aix, and for ſeveral miles round. This ſuppoſed ſhower of blood, M. de Reaumur remarks, would probably have been tranſmitted to us as a great and a real prodigy, if Aix had not then been poſſeſſed of a philoſopher, who, amidſt other ſpecies of knowledge, did not neglect the operations and oeconomy of inſects. This philoſopher was M. de Peireſc, whoſe life is written by Gaſſendi. This life contains a number of curious facts and obſervations. Among others, M. de Peireſc diſcovered the cauſe of the pretended ſhower of blood at Aix, which had created ſo general an alarm. About the beginning of July, the walls of a church-yard adjacent to the city, and particularly the walls of the ſmall villages in the neighbourhood, were obſerved to be ſpotted with large drops of a blood-coloured liquid. The people, as well as ſome theologians, conſidered thoſe drops as the operation of ſorcerers, or of the Devil himſelf. M. de Peireſc, about that time, had picked up a large and beautiful chryſalis, which he laid in a box. Immediately after its transformation into the butterfly ſtate, M. de Peireſc remarked, that it had left a drop of blood-coloured liquor on the bottom of the box, and that this drop, or ſtain, was as large as a French ſou. The red ſtains on the walls, on ſtones near the highways, and in the fields, were found to be perfectly ſimilar to that on the bottom of M. de Peireſc's box. He now no longer heſitated to pronounce, that all thoſe blood-coloured ſtains, wherever they appeared, proceeded from the ſame cauſe. The prodigious number of butterflies which he, at the ſame time, ſaw flying in the air, confirmed his original idea. He likewiſe obſerved, that the drops of the miraculous rain were never found in the middle of the city; that they appeared only in places bordering upon the country; and that they never fell upon the tops of houſes, or upon walls more elevated than the height to which butterflies generally riſe. What M. de Peireſc ſaw himſelf, he ſhowed to many perſons of knowledge, or of curioſity, and eſtabliſhed it as an inconteſtible fact, that the pretended drops of blood were, in reality, drops of a red liquor depoſited by butterflies.

To the ſame cauſe M. de Peireſc attributes ſome other ſhowers of blood related by hiſtorians; and it is worthy of remark, that all of them are ſaid to have happened in the warm ſeaſons of the year, when butterflies are moſt numerous. Among others, Gregory of Tours mentions a ſhower of blood which fell, in the time of Childebert, in different parts of Paris, and upon a certain houſe in the territory of Senlis; and, about the end of the month of June, another likewiſe fell under the reign of King Robert.

M. de Reaumur remarks, that almoſt all the butterflies which proceeded from different ſpecies of hairy caterpillars in his poſſeſſion, voided at leaſt one, and often ſeveral large drops of excrement, which had the colour of blood. The hairy caterpillar that feeds upon the leaves of the elm-tree, after its transformation, emits drops, the colour of which is of a more deep red than that of blood; and, after being dried, their colour approaches to that of carmine. From another caterpillar of the elm, which is larger, and much more common than the former, proceeds a butterfly, that, immediately after its transformation, emits a great quantity of red excrement. This ſpecies of caterpillar, in particular years, is ſo numerous, that it lays bare the whole trees in certain diſtricts. Myriads of them are tranſformed into chryſalids about the end of May or beginning of June. When about to undergo their metamorphoſis, they often attach themſelves to the walls, and even enter into the country houſes. If theſe butterflies were all brought forth at the ſame time, and flew in the ſame direction, their number would be ſufficient to form ſmall clouds, to cover the ſtones, &c. of particular diſtricts with blood-coloured ſpots, and to convince thoſe who wiſh to fright themſelves, and to ſee prodigies, that a ſhower of blood had fallen during the night. Some of thoſe hairy caterpillars which live in ſociety upon nettles, likewiſe emit an excrementitious matter of a red colour. A thouſand examples of the ſame kind might be enumerated. Hence the notion of miraculous or portentous ſhowers of blood ſhould be forever baniſhed from the minds of men.

I would not have ſaid ſo much upon this ſubject, if I had not conſidered it to be the duty of every man, when it is in his power, to remove popular prejudices, eſpecially when they have a direct tendency to terrify the minds of men, and to cheriſh ignorance and ſuperſtition.

We not only read of ſhowers, but, what ſeems to be more unaccountable, of fountains running occaſionally with blood inſtead of water. Sir David Dalrymple, one of the Senators of the College of Juſtice in Scotland, a gentleman not more diſtinguiſhed by his learning and deep reſearch, than by his ſcrupulous integrity and propriety of conduct, relates, in his Annals of Scotland *, upon the authority of Hoveden and Benedictus Abbas, that, in the year 1184, ‘ A fountain near Kilwinning †, in the ſhire of Air, ran blood for ‘ eight days and eight nights without intermiſſion. This portent ‘ had frequently appeared, but never for ſo long a ſpace. In the ‘ opinion of the people of the country, it prognoſticated the effuſion ‘ of blood. Benedictus Abbas, and R. Hoveden, relate the ſtory of ‘ this portent with perfect credulity. Benedictus Abbas improves a ‘ little upon his brother; for he is poſitive that the fountain flowed ‘ with *pure* blood.’ If Kilwinning, like Aix, had poſſeſſed ſuch a philoſopher as Peireſc, the redneſs of the water, if ever it did appear, would have received a moſt ſatisfactory explanation.

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* Vol. 1. page 298.

† A Scottiſh village.

Transformations are not peculiar to animals. All *organized bodies* paſs through ſucceſſive changes. Plants, of courſe, are not exempted from mutation. What an amazing difference between an acorn and a ſtately oak? The ſeeds of plants may be compared to the chryſalids of butterflies. The ſeed, like the chryſalis, contains, in miniature, all the parts of the future plant. Theſe parts require only time, and other circumſtances neceſſary to vegetation, for their complete evolution. How different are the ſeed-leaves from thoſe of the plume? Beſide the general changes ariſing from growth, plants undergo a number of metamorphoſes from other cauſes. In northern climates, if we except a few evergreens, trees, during winter, are entirely ſtripped of their leaves. Inſtead of the pleaſant emotions excited by the variety of figures, movements, colours, and fragrance of the leaves, flowers, and fruit, during the ſpring and ſummer, nothing is exhibited in winter but the bare ſtems and branches. In this ſtate, the trees of the foreſt have a lugubrious appearance, and remind us of death and of ſkeletons. Very different are the emotions we feel in the ſpring, when the buds begin to burſt, and the leaves to expand. When ſummer approaches, another beautiful change takes place. The flowers, with all their ſplendour of colours, and ſweetneſs of flavours, are then highly delightful to our ſenſes. After performing the office of cheriſhing and protecting the tender fruit for ſome time, the flowers drop off, and a new change is exhibited. When the flowers fall, the young fruit appear, and gradually grow to maturity, perpetually preſenting varieties in their magnitude, colour, odour, and flavour. When the fruit or ſeeds are fully ripe, they are gathered for the uſe of man, drop down upon the earth, or are devoured by birds and other animals. After this change happens, to which all the others were only preparatory, the leaves begin to ſhed, winter commences, and the ſame ſeries of metamorphoſes go on during the exiſtence of the plant.

The changes juſt now mentioned are annual, and are ultimately intended to ſupply men and other animals with food. But plants are ſubjected to changes of form from cauſes of a more accidental nature. Varieties or changes in the figure of plants are often produced by ſoil, by ſituation, by culture, and by climate.

A plant is compoſed of the bark, the liber or inner circle, the wood, and the pith. The calyx or cup, the carolla or flower leaves, the ſtamina, and piſtils, are only expanſions of the bark, the liber, the wood, and the pith. The petals of all flowers, in a natural ſtate, are ſingle. But, when tranſplanted into gardens, many of them, eſpecially thoſe which are furniſhed with numerous ſtamina, as the anemone, the poppy, the peony, the ranunculus, the daiſy, the marigold, the roſe, &c. double, or rather multiply their flower-leaves without end. This change from ſingle to double, or monſtrous flowers, as they are called, is produced by too great a quantity of nutricious juices, which prevents the ſubſtance of the liber from condenſing into wood, and transforms the ſtamina into petals ; and it not unfrequently happens, that, when theſe double flowering plants are committed to a poor ſoil, they become drier, are reduced to their natural ſtate, and produce ſingle flowers only. Plants which inhabit the valleys, when tranſported to the tops of mountains, or other elevated ſituations, not only become dwarfiſh, but undergo ſuch changes in their general ſtructure and appearance, that they are often thought to belong to a different ſpecies, though they are, in reality, only varieties of the ſame. Similar changes are produced when Alpine or mountain plants are cultivated in the valleys.

From culture and climate, likewiſe, plants undergo many changes. But this ſubject is ſo generally known, that to enlarge upon it would be entirely ſuperfluous. We ſhall only remark, that the older botaniſts, when they perceived the ſame ſpecies of plants growing

ing in a different ſoil, or in a different climate, aſſume ſuch different appearances, conſidered and enumerated them as diſtinct ſpecies. But the modern botaniſts, to prevent the unneceſſary multiplication of ſeparate beings, have endeavoured to reduce all thoſe varieties ariſing from fortuitous circumſtances to their original ſpecies.

From theſe facts, and many others which might be mentioned, it appears, that, in both the animal and vegetable kingdoms, forms are perpetually changing. The mineral kingdom is not leſs ſubject to metamorphoſes; but theſe belong not to our preſent ſubject. Though forms continually change, the quantity of matter is invariable. The ſame ſubſtances paſs ſucceſſively into the three kingdoms, and conſtitute, in their turn, a mineral, a plant, an inſect, a reptile, a fiſh, a bird, a quadruped, a man. In theſe transformations, organized bodies are the principal agents. They change or decompoſe every ſubſtance that either enters into them, or is expoſed to the action of their powers. Some they aſſimulate, by the proceſs of nutrition, into their own ſubſtance; others they evacuate in different forms; and theſe evacuations make ingredients in the compoſitions of other bodies, as thoſe of inſects, whoſe multiplication is prodigious, and affords a very great quantity of organized matter for the nouriſhment and ſupport of almoſt every animated being. Thus, from the apparently vileſt and moſt contemptible ſpecies of matter, the richeſt productions derive their origin. The moſt beautiful flowers, the moſt exquiſite fruits, and the moſt uſeful grain, all proceed from the boſom of corruption. The earth is continually beſtowing freſh gifts upon us; and her powers would ſoon be exhauſted, if what ſhe perpetually gives were not perpetually reſtored to her. It is a law of Nature, that all organized bodies ſhould be decompoſed, and gradually transformed into earth. While undergoing this ſpecies of diſſolution, their more volatile particles paſs into the air, and are diffuſed through the atmoſphere. Thus animals, at leaſt portions of them, are buried in the air, as well as in the earth, or in water. Theſe floating particles ſoon enter into the compoſition of new organized beings, who are themſelves deſtined to undergo the ſame revolutions. This circulation of organized matter has continued ſince the commencement of the world, and will proceed in the ſame courſe till its final deſtruction.

With regard to the intentions of Nature in changing forms, a complete inveſtigation of them exceeds the powers of human reſearch. One great intention, from the examples above enumerated, cannot eſcape obſervation. In the animal world, every ſucceſſive change is a new approach to the perfection of the individuals. Men, and the larger animals, ſome time after the age of puberty, remain ſtationary, and continue to multiply their ſpecies for periods proportioned to their reſpective ſpecies. When thoſe periods terminate, they gradually decay till their final diſſolution. The ſame obſervation is applicable to the inſect tribes, whoſe transformations ſtrike us with wonder. The caterpillar repeatedly moults or caſts off its ſkin. The butterfly exiſted originally in the body of the caterpillar; but the organs of the fly were too ſoft, and not ſufficiently unfolded. It remains unfit to encounter the open air, or to perform the functions of a perfect animal, till ſome time after its transformation into a chryſalis. It then burſts through its envelope, arrives at a ſtate of perfection, multiplies its ſpecies, and dies. All the changes in the vegetable kingdom tend to the ſame point. In the proceſs of growing, they are perpetually changing forms till they produce fruit, and then they decay. Some plants, like caterpillars, go through all their transformations, death not excepted, in one year. But others, like man and the larger animals, beſide the common changes produced by growth and the evolution of different organs, continue for many years in a ſtate of perfection before the periods of decay and of diſſolution arrive. But theſe perennial plants undergo, every year, all the viciſſitudes of the annuals. They every year increaſe in magnitude, ſend forth new leaves and branches, ripen and diſſeminate their ſeeds, and, during winter, remain in a torpid ſtate, or ſuffer a temporary death. Theſe annual changes in trees, &c. have ſome reſemblance to thoſe of animals which produce at certain ſtated ſeaſons only.

The diſtribution of life to an immenſity of ſucceſſive individuals ſeems to be another intention of Nature in changing forms, and in the diſſolution of her productions. Were the exiſtence of individuals perpetual, or were it prolonged for ten times the periods now eſtabliſhed, life would be denied to myriads of animated beings, who enjoy their preſent limited portion of happineſs.

CHAPTER XIII.

Of the Habitations of Animals.

MANY animals, as well as thoſe of the human ſpecies, are endowed by Nature with an architectonic faculty. This faculty is beſtowed upon them for a number of wiſe and uſeful purpoſes. It enables them to conſtruct proper habitations for concealing themſelves, for defending them againſt the attacks of their enemies, for ſheltering and cheriſhing their young, and for protecting them from the injuries of the weather.

All animals of the ſame ſpecies, when not reſtrained by accidental cauſes, uniformly build in the ſame ſtyle, and uſe the ſame materials. From this general rule man is to be excepted. Poſſeſſed of a ſuperior number of inſtincts, of which the reaſoning faculty is a reſult *, he can build in any ſtyle, and employ ſuch materials as his taſte, his fancy, or the purpoſes for which the fabric is intended, ſhall direct him. A cottage or a palace are equally within the reach of his powers. In treating of this ſubject, we mean not to trace the progreſs of human architecture, which, in the earlier ſtages of ſociety, is extremely rude, but to confine ourſelves to that of the inferior tribes of animated beings.

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* See Chap. V. Of Inſtinct.

With regard to *Quadrupeds*, many of them employ no kind of architecture, but live continually, and bring forth their young, in the open air. When not under the immediate protection of man, theſe ſpecies, in rough or ſtormy weather, ſhelter themſelves among trees or buſhes, retire under the coverture of projecting rocks, or the ſides of hills oppoſite to thoſe from which the wind proceeds. Beſide theſe arts of defence, to which the creatures are prompted by inſtinct and experience, Nature furniſhes them, during the winter months, with a double portion of long hair, which protects them from cold, and other aſſaults of the weather.

Of the quadrupeds that make or chooſe habitations for themſelves, ſome dig holes in the earth, ſome take refuge in the cavities of decayed trees, and in the clefts of rocks, and ſome actually construct cabins or houſes. But the artifices they employ, the materials they uſe, and the ſituations they ſelect, are ſo various, and ſo numerous, that our plan neceſſarily limits us to a few of the more curious examples.

The Alpine marmot is a quadruped about ſixteen inches in length, and has a ſhort tail. In figure, the marmots have ſome reſemblance both to the rat and to the bear. When tamed, they eat every thing preſented to them, as fleſh, bread, fruit, roots, pot-herbs, inſects, &c. They delight in the regions of froſt and of ſnow, and are only to be found on the tops of the higheſt mountains. Theſe animals remain in a torpid ſtate during winter. About the end of September or the beginning of October, they retire into their holes, and never come abroad again till the beginning of April. Their retreats are formed with much art and precaution. With their feet and claws, which are admirably adapted to the purpoſe, they dig the earth with amazing quickneſs, and throw it behind them. They do not make a ſimple hole, or a ſtraight or winding tube, but a kind of gallery in the form of a Y, each branch of which has an aperture, and both terminate in a capacious apartment, where ſeveral of the animals lodge together. As the whole operation is performed on the declivity of a mountain, this innermoſt apartment is alone horizontal. Both branches of the Y are inclined. One of the branches deſcends under the apartment, and follows the declivity of the mountain. This branch is a kind of aqueduct, and receives and carries off the excrements of the animals; and the other, which riſes above the principal apartment, is uſed for coming in and going out. The place of their abode is well lined with moſs and hay, of which they lay up great ſtore during the ſummer. They are ſocial animals. Several of them live together, and work in common when forming their habitations. Thither they retire during rain, or upon the approach of danger. One of them ſtands centinel upon a rock, while the others gambol upon the graſs, or are employed in cutting it, in order to make hay. If the centinel perceives a man, an eagle, a dog, or other dangerous animal, he alarms his companions by a loud whiſtle, and is himſelf the laſt that enters the hole. As they continue torpid during winter, and, as if they foreſaw that they would then have no occaſion for victuals, they lay up no proviſions in their apartments. But, when they feel the firſt approaches of the ſleeping ſeaſon, they ſhut up both paſſages to their habitation; and this operation they perform with ſuch labour and ſolidity, that it is more eaſy to dig the earth any where elſe than in ſuch parts as they have thus fortified. At this time they are very fat, weighing ſometimes twenty pounds. They continue to be plump for three months; but afterwards they gradually decline, and, at the end of winter, they are extremely emaciated. When ſeized in their retreats, they appear rolled up in the form of a ball, and covered with hay. In this ſtate, they are ſo torpid that they may be killed without ſeeming to feel pain. The hunters ſelect the fatteſt for eating, and keep the young ones for taming. Like the dormice, and all the other animals which ſleep during winter, the marmots are revived by a gradual and gentle heat: And it is remarkable, that thoſe which are fed in houſes, and kept warm, never become torpid, but are equally active and lively during the whole year.

We ſhall now give a ſhort account of the operations and architecture of the *beaver*. This amphibious quadruped is about three feet in length, and its tail, which is of an oval figure, and covered with ſcales, is eleven inches long. He uſes his tail as a rudder to direct his courſe in the water. In places much frequented by man, the beavers neither aſſociate nor build habitations. But, in the northern regions of both Continents, they aſſemble in the month of June or July, for the purpoſes of uniting into ſociety and of building a city. From all quarters they arrive in numbers, and ſoon form a troop of two or three hundred. The operations and architecture of the beavers are ſo well deſcribed by the Count de Buffon, that we ſhall lay it before our readers nearly in his own words. The place of rendezvous, he remarks, is generally the ſituation fixed upon for their eſtabliſhment, and it is always on the banks of waters. If the waters be flat, and ſeldom riſe above their ordinary level, as in lakes, the beavers make no bank or dam. But in rivers or brooks, where the water is ſubject to riſings and fallings, they build a bank, which traverſes the river from one ſide to the other, like a ſluice, and is often from 80 to 100 feet long, by 10 or 12 broad at the baſe. This pile, for animals of ſo ſmall a ſize, appears to be enormous, and preſuppoſes an incredible labour *. But the ſolidity with

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* The largeſt beavers weigh only 50 or 60 pounds.

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[*] The largeſt beavers weigh only 50 or 60 pounds.

which the work is conſtructed is ſtill more aſtoniſhing than its magnitude. The part of the river where they erect this bank is generally ſhallow. If they find on the margin a large tree, which can be made to fall into the river, they begin, by cutting it down, to form the principal baſis of their work. This tree is often thicker than a man's body. By gnawing it at the bottom with their four cutting teeth, they in a ſhort time accompliſh their purpoſe, and always make the tree fall acroſs the river. They next cut the branches from the trunk to make it lie level. Theſe operations are performed by the joint induſtry of the whole community. Some of them, at the ſame time, traverſe the banks of the river, and cut down ſmaller trees, from the ſize of a man's leg to that of his thigh. Theſe they cut to a certain length, dreſs them into ſtakes, and firſt drag them by land to the margin of the river, and then by water to the place where the building is carrying on. Theſe piles they ſink down, and interweave the branches with the larger ſtakes. In performing this operation many difficulties are to be ſurmounted. In order to dreſs theſe ſtakes, and to put them in a ſituation nearly perpendicular, ſome of the beavers muſt elevate, with their teeth, the thick ends againſt the margin of the river, or againſt the croſs tree, while others plunge to the bottom, and dig holes with their fore-feet to receive the points, that they may ſtand on end. When ſome are labouring in this manner, others bring earth, which they plaſh with their feet, and beat firm with their tails. They carry the earth in their mouths, and with their fore-feet. They tranſport earth in ſuch quantities, that they fill with it all the intervals between the piles. Theſe piles conſiſt of ſeveral rows of ſtakes, of equal height, all placed oppoſite to each other, and extend from one bank of the river to the other. The ſtakes facing the under part of the river are placed perpendicularly; but thoſe which are oppoſed to the ſtream ſlope upward to ſuſtain the preſſure of the water; ſo that the bank, which is ten or twelve feet wide at the baſe, is reduced to two or three at the top. Near the top, or thinneſt part of the bank, the beavers make two or three ſloping holes, to allow the ſurface-water to eſcape. Theſe they enlarge or contract in proportion as the river riſes or falls; and, when any breaches are made in the bank by ſudden or violent inundations, they know how to repair them when the water ſubſides.

Hitherto all theſe operations were performed by the united force and dexterity of the whole community. They now ſeparate into ſmaller ſocieties, who build cabins or houſes. Theſe cabins are conſtructed upon piles near the margin of the river or pond, and have two openings, one for the animals going to the land, and the other for throwing themſelves into the water. The form of theſe edifices is either round or oval, and they vary in ſize from four or five to eight or ten feet in diameter. Some of them conſiſt of three or four ſtories. Their walls are about two feet thick; and are raiſed perpendicularly upon planks, or plain ſtakes, which ſerve both for foundations and floors to their houſes. When they conſiſt of but one ſtory, they riſe perpendicularly a few feet only, afterwards aſſume a curved form, and terminate in a dome or vault, which anſwers the purpoſe of a roof. They are built with amazing ſolidity, and neatly plaſtered with a kind of ſtucco both within and without. In the application of this mortar the tails of the beavers ſerve for trowels, and their feet for plaſhing. Their houſes are impenetrable to rain, and reſiſt the moſt impetuous winds. In their conſtruction, they employ different materials, as wood, ſtone, and a kind of ſandy earth, which is not liable to be diſſolved in water. The wood they uſe is generally of the light and tender kinds, as alders, poplars, and willows, which commonly grow on the banks of rivers, and are more eaſily barked, cut, and tranſported, than the heavier and more ſolid ſpecies of timber. They always begin the operation of cutting trees at a foot or a foot and a half above the ground: They labour in a ſitting poſture; and, beſide the convenience of this poſture, they enjoy the pleaſure of gnawing perpetually the bark and wood, which are their favourite food. Of theſe proviſions they lay up ample ſtores in their cabins to ſupport them during the winter. Each cabin has its own magazine, which is proportioned to the number of its inhabitants, who have all a common right to the ſtore, and never pillage their neighbours. Some villages are compoſed of twenty or twenty-five cabins. But theſe large eſtabliſhments are not frequent; and the common republics ſeldom exceed ten or twelve families, of which each have their own quarter of the village, their own magazine, and their ſeparate habitation. The ſmalleſt cabins contain two, four, or ſix, and the largeſt eighteen, twenty, and ſometimes thirty beavers. As to males and females, they are almoſt always equally paired. Upon a moderate computation, therefore, the ſociety is often compoſed of 150 or 200, who all, at firſt, labour jointly in raiſing the great public building, and afterwards, in ſelect tribes or companies, in making particular habitations. In this ſociety, however numerous, an univerſal peace is maintained. Their union is cemented by common labours; and it is perpetuated by mutual conveniency, and the abundance of proviſions which they amaſs and conſume together. A ſimple taſte, moderate appetites, and an averſion to blood and carnage, render them deſtitute of the ideas of rapine and of war. Friends to each other, if they have any foreign enemies they know how to avoid them. When danger approaches, they advertiſe one another, by ſtriking their broad tail on the ſurface of the water, the noiſe of which is heard at a great diſtance, and reſounds through all the vaults of their habitations. Each individual, upon theſe occaſions, conſults his own ſafety; ſome plunge into the water; others conceal themſelves within their walls, which can be penetrated only by the fire of heaven, or the ſteel of man, and which no animal will attempt either to open or to overturn. Theſe retreats are not only ſafe, but neat and commodious. The floors are ſpread over with verdure: The branches of the box and of the fir ſerve them for carpets, upon which they permit not the ſmalleſt dirtineſs. The window that faces the water anſwers for a balcony to receive the freſh air, and for the purpoſe of bathing. During the greater part of the day, the beavers ſit on end, with their head and the anterior parts of their body elevated, and their poſterior parts ſunk in the water. The aperture of this window is ſufficiently raiſed to prevent its being ſtopped up with the ice, which, in the beaver climates, is often two or three feet thick. When this accident happens, they ſlope the ſole of the window, cut obliquely the ſtakes which ſupport it, and thus open a communication with the unfrozen water. They often ſwim a long way under the ice. The continual habit of keeping their tail and poſterior parts of their body in the water, appears to have changed the nature of their fleſh; for that of their anterior parts, as far as the reins, has the taſte and conſiſtence of the fleſh of land-animals; but that of the tail and poſterior parts has the odour and all the other qualities of fiſh. The tail, which is a foot long, an inch thick, and five or ſix inches broad, is a genuine portion of a fiſh attached to the body of a quadruped: It is wholly covered with ſcales, and below the ſcales with a ſkin perfectly ſimilar to that of large fiſhes. In September, the beavers collect their proviſions of bark and of wood. Till the end of winter, they remain in their cabins, enjoy the fruits of their labours, and taſte the ſweets of domeſtic happineſs. This is their time of repoſe, and their ſeaſon of love. Knowing and loving one another, each couple unite, not by chance, but by taſte and a real ſelection. The females bring forth in the end of winter, and generally produce two or three at a time. About this period they are left by the males, who retire to the country to enjoy the pleaſures and the fruits of the ſpring. They return occaſionally, however, to their cabins; but dwell there no more. The mothers continue in the cabins, and are occupied in nurſing, protecting, and rearing their young, which in a few weeks are in a condition to follow their dams. The beavers aſſemble not again till autumn, unleſs their banks or cabins be injured by inundations; for, when accidents of this kind happen, they ſuddenly collect their forces, and repair the breaches that have been made.

This account of the ſociety and operations of beavers, however marvellous it may appear, has been eſtabliſhed and confirmed by ſo many credible eye-witneſſes, that it is impoſſible to doubt of its reality.

The habitation where *moles* depoſit their young merits a particular deſcription; becauſe it is conſtructed with peculiar intelligence, and becauſe the mole is an animal with which we are well acquainted. They begin by raiſing the earth, and forming a pretty high arch. They leave partitions, or a kind of pillars, at certain diſtances, beat and preſs the earth, interweave it with the roots of plants, and render it ſo hard and ſolid, that the water cannot penetrate the vault, on account of its convexity and firmneſs. They then elevate a little hillock under the principal arch; upon the latter they lay herbs and leaves for a bed to their young. In this ſituation they are above the level of the ground, and, of courſe, beyond the reach of ordinary inundations. They are, at the ſame time, defended from the rains by the large vault that covers the internal one, upon the convexity of which laſt they reſt along with their young. This internal hillock is pierced on all ſides with ſloping holes, which deſcend ſtill lower, and ſerve as ſubterraneous paſſages for the mother to go in queſt of food for herſelf and her offspring. Theſe by-paths are beaten and firm, extend about twelve or fifteen paces, and iſſue from the principal manſion like rays from a centre. Under the ſuperior vault we likewiſe find remains of the roots of the meadow ſaffron, which ſeem to be the firſt food given to the young. From this deſcription it appears, that the mole never comes abroad but at conſiderable diſtances from her habitation. Moles, like the beavers, pair; and ſo lively and reciprocal an attachment ſubſiſts between them, that they ſeem to diſreliſh all other ſociety. In their dark abodes they enjoy the placid habits of repoſe and of ſolitude, the art of ſecuring themſelves from injury, of almoſt inſtantaneouſly making an aſylum or habitation, and of procuring a plentiful ſubſiſtence without the neceſſity of going abroad. They ſhut up the entrance of their retreats, and ſeldom leave them, unleſs compelled by the admiſſion of water, or when their manſions are demoliſhed by art.

The nidification of *Birds* has at all times deſervedly called forth the admiration of mankind. In general, the neſts of birds are built with an art ſo exquiſite, that an exact imitation of them exceeds all the powers of human ſkill and induſtry. Their ſtyle of architecture, the materials they employ, and the ſituations they ſelect, are as various as the different ſpecies. Individuals of the ſame ſpecies, whatever region of the globe they inhabit, collect the ſame materials, arrange and conſtruct them in the ſame form, and make choice of ſimilar ſituations for erecting their temporary habitations; for the neſts of birds, thoſe of the eagle-kind excepted, after the young have come to maturity, are forever abandoned by the parents.

To deſcribe minutely the neſts of birds would be a vain attempt. Such deſcriptions could not convey an adequate idea of their architecture to a perſon who had never ſeen one of thoſe beautiful and commodious habitations, which even aſtoniſh and excite the amazement of children.

The different orders of birds exhibit great variety in the materials and ſtructure of their neſts. Thoſe of the rapacious tribes are in general rude, and compoſed of courſe materials, as dried twigs, bents, &c. But they are often lined with ſoft ſubſtances. They build in elevated rocks, ruinous and ſequeſtered caſtles and towers, and in other ſolitary retirements. The aiery or neſt of the eagle is quite flat, and not hollow, like thoſe of other birds. The male and female commonly place their neſt between two rocks, in a dry and inacceſſible ſituation. The ſame neſt, it is ſaid, ſerves the eagle during life. The ſtructure is ſo conſiderable, and compoſed of ſuch ſolid materials, that it may laſt many years. Its form reſembles that of a floor. Its baſis conſiſts of ſticks about five or ſix feet in length, which are ſupported at each end, and theſe are covered with ſeveral layers of ruſhes and heath. An eagle's neſt was found in the Peak of Derbyſhire, which Willoughby deſcribes in the following manner: 'It was made of great ſticks, reſting one end 'on the edge of a rock, the other on a birch tree. Upon theſe was 'a layer of ruſhes, and over them a layer of heath, and on the 'heath ruſhes again; upon which lay one young, and an addle egg; 'and by them a lamb, a hare, and three heath pouts. The neſt was 'about two yards ſquare, and had no hollow in it.' But the butcher-birds, or ſhrikes, which are leſs rapacious than eagles and hawks, build their habitations in ſhrubs and buſhes, and employ moſs, wool, and other ſoft materials.

The birds belonging to the order of *Pies* in the ingenious Mr Pennant's Genera of Birds, are extremely irregular in conſtructing their neſts. The common magpies build their neſts in trees, and their ſtructure is admirably contrived for affording warmth and protection to the young. The neſt is not open at top: It is covered, in the moſt dexterous manner, with an arch or dome, and a ſmall opening in the ſide of it is left, to give the parents an opportunity of paſſing in and out at their pleaſure. To protect their eggs and young from the attacks of other animals, the magpies place, all round the external ſurface of their neſt, ſharp briars and thorns. The long-tailed titmouſe, or ox-eye, builds nearly like the wren, but with ſtill greater art. With the ſame materials as the reſt of the ſtructure, the titmouſe builds an arch over the top of the neſt, which reſembles an egg erected upon one end, and leaves a ſmall hole in the ſide for a paſſage. Both eggs and young, by this contrivance, are defended from the injuries of the air, rain, cold, &c. That the young may have a ſoft and warm bed, ſhe lines the inſide of the neſt with feathers, down, and cobwebs. The ſides and roof are compoſed of moſs and wool interwoven in the moſt curious and artificial manner.

In treating of inſtinct, it was mentioned, that, in warm climates, many ſmall birds ſuſpended their neſts on tender twigs of trees, to prevent them from being deſtroyed by the monkeys. In Europe, there are only three birds which build penſile neſts, namely, the common oriola, the *parus pendulinus*, or hang-neſt titmouſe; and another penſile neſt, belonging to ſome unknown bird, was lately diſcovered by Mr Pennant, near the houſe of Blair in Athole, in the north of Scotland. 'In a ſpruce fir-tree,' Mr Pennant remarks, 'was a hang-neſt of ſome unknown bird, ſuſpended at the four corners to the boughs. It was open at top, an inch and a half diameter, and two deep; the ſides and bottom thick; the materials moſs, worſted, and birch bark, lined with feathers [*].'

Mr Pennant, in his Indian Zoology, gives the following curious account of the manner in which the motacilla ſutoria, or taylor bird, builds its neſt. 'Had providence,' Mr Pennant remarks, 'left the feathered tribes unendowed with any particular inſtinct, the birds of the torrid zone would have built their neſts in the ſame unguarded manner as thoſe of Europe; but there the leſſer ſpecies, having a certain preſcience of the dangers that ſurround them, and of their own weakneſs, ſuſpend their neſts at the extreme branches of the trees: They are conſcious of inhabiting a climate replete with enemies to them and their young; with ſnakes that twine up

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[*] Pennant's Tour, vol. 1. pag. 104. 3d edit.

‘ the bodies of the trees, and apes that are perpetually in ſearch of ‘ prey; but, heaven-inſtructed, they elude the gliding of the one, ‘ and the activity of the other.—The brute creation are more at ‘ enmity with one another than in other climates; and the birds ‘ are obliged to exert an unuſual artifice in placing their little broods ‘ out of the reach of an invader. Each aims at the ſame end, though ‘ by different means; ſome form their penſile neſt in ſhape of a ‘ purſe, deep and open at top, others with a hole in the ſide, and ‘ others, ſtill more cautious, with an entrance at the very bottom, ‘ forming their lodge near the ſummit *. But the taylor-bird ſeems ‘ to have greater diffidence than any of the others: It will not truſt ‘ its neſt even to the extremity of a ſlender twig, but makes one ‘ more advance to ſafety by fixing it to the leaf itſelf. It picks up ‘ a dead leaf, and, ſurpriſing to relate, ſews it to the ſide of a living ‘ one †, its ſlender bill being its needle, and its thread ſome fine ‘ fibres, the lining feathers, goſſamer, and down. Its eggs are white, ‘ the colour of the bird light yellow; its length three inches; its ‘ weight only three ſixteenths of an ounce; ſo that the materials of ‘ the neſt, and its own ſize, are not likely to draw down a habita‘tion that depends on ſo ſlight a tenure ‡.’

Birds of the gallinaceous or poultry kind lay their eggs on the ground. Some of them ſcrape a kind of hole in the earth, and line it with a little long graſs or ſtraw.

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* This inſtinct prevails alſo among the birds on the banks of the Gambia, in Africa, which abounds with monkeys and ſnakes; others, for the ſame end, make their neſt in holes of the banks that overhang that vaſt river; Purchas, vol. 2. pag. 1576.

† A neſt of this bird is preſerved in the Britiſh Muſaeum.

‡ Pennant's Indian Zoology, pag. 7.

It is a ſingular, though a well atteſted fact, that the cuckow makes no neſt, and neither hatches nor feeds her own young. 'The hedge-'ſparrow,' ſays Mr Willoughby, 'is the cuckow's nurſe, but not 'the hedge-ſparrow only, but alſo ring-doves, larks, finches. I 'myſelf, with many others, have ſeen a wag-tail feeding a young 'cuckow. The cuckow herſelf builds no neſt; but having found 'the neſt of ſome little bird, ſhe either devours or deſtroys the eggs 'ſhe there finds, and, in the room thereof, lays one of her own, and 'ſo forſakes it. The ſilly bird returning, ſits on this egg, hatches 'it, and, with a great deal of care and toil, broods, feeds, and che'riſhes the young cuckow for her own, until it be grown up and 'able to fly and ſhift for itſelf. Which thing ſeems ſo ſtrange, 'monſtrous, and abſurd, that for my part I cannot ſufficiently won'der there ſhould be ſuch an example in Nature; nor could I ever 'have been induced to believe that ſuch a thing had been done by 'Nature's inſtinct, had I not with mine own eyes ſeen it. For Na'ture, in other things, is wont conſtantly to obſerve one and the 'ſame law and order, agreeable to the higheſt reaſon and prudence; 'which in this caſe is, that the dams make neſts for themſelves, if 'need be, ſit upon their own eggs, and bring up their own young 'after they are hatched *.' This oeconomy, in the hiſtory of the cuckow, is not only ſingular, but ſeems to contradict one of the moſt univerſal laws eſtabliſhed among animated beings, and particularly among the feathered tribes, namely, the hatching and rearing of their offspring. Still, however, like the oſtrich in very warm climates, though the cuckow neither hatches nor feeds her young, ſhe places her eggs in ſituations where they are both hatched and her offspring brought to maturity. Here the ſtupidity of the one animal makes it a dupe to the rapine and chicane of the other; for the cuckow always deſtroys the eggs of the ſmall bird before ſhe depoſits her own.

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* Willoughby's Ornithology, pag. 98.

Moſt of the paſſerine or ſmall tribes build their neſts in hedges, ſhrubs, or buſhes; though ſome of them, as the lark and the goatſucker, build upon the ground. The neſts of ſmall birds are more delicate in their ſtructure and contrivance than thoſe of the larger kinds. As the ſize of their bodies, and likewiſe that of their eggs, are ſmaller, the materials of which their neſts are compoſed are generally warmer. Small bodies retain heat a ſhorter time than thoſe which are large. Hence the eggs of ſmall birds require a more conſtant ſupply of heat than thoſe of greater dimenſions. Their neſts, accordingly, are built proportionally warmer and deeper, and they are lined with ſofter ſubſtances. The larger birds, of courſe, can leave their eggs for ſome time with impunity; but the ſmaller kinds ſit moſt aſſiduouſly; for, when the female is obliged to go abroad in queſt of food, the neſt is always occupied by the male. When a neſt is finiſhed, nothing can exceed the dexterity of both male and female in concealing it from the obſervation of man, and of other deſtructive animals. If it is built in buſhes, the pliant branches are diſpoſed in ſuch a manner as to hide it entirely from view. To conceal her retreat, the chaffinch covers the outſide of her neſt with moſs, which is commonly of the ſame colour with the bark of the tree on which ſhe builds. The common ſwallow builds its neſt on the tops of chimneys; and the martin attaches hers to the corners of windows, or under the eaves of houſes. Both employ the ſame materials. The neſt is built with mud well tempered by the bill, and moiſtened with water to make it more firmly cohere; and the mud or clay is kept ſtill firmer by a mixture of ſtraw or graſs. Within it is neatly lined with feathers. Willoughby, on the authority of Bontius, informs us, ‘ That, on the ſea coſt of the king‘ dom of China, a ſort of ſmall party-coloured birds, of the ſhape ‘ of ſwallows, at a certain ſeaſon of the year, viz. their breeding ‘ time, come out of the midland country to the rocks; and from ‘ the foam or froth of the ſea-water daſhing and breaking againſt

‘ the bottom of the rocks, gather a certain clammy, glutinous mat-
‘ ter, perchance the ſperm of whales, or other fiſhes, of which they
‘ build their neſts, wherein they lay their eggs, and hatch their
‘ young. Theſe neſts the Chineſe pluck from the rocks, and bring
‘ them in great numbers into the Eaſt Indies to ſell; which are
‘ eſteemed by gluttons great delicacies, who, diſſolving them in
‘ chicken or mutton broth, are very fond of them, preferring them
‘ far before oyſters, muſhrooms, or other dainty and lickeriſh mor-
‘ ſels which moſt gratify the palate.—Theſe neſts are of a hemiſ-
‘ pherical figure, of the bigneſs of a gooſe-egg, and of a ſubſtance
‘ reſembling iſing-glaſs *.’

Moſt of the cloven-footed water-fowls, or waders, lay their eggs upon the ground. But the ſpoon-bills and the common heron build large neſts in trees, and employ twigs and other coarſe materials; and the ſtorks build on churches, or on the tops of houſes. Many of the web-footed fowls lay their eggs likewiſe on the ground, as the terns, and ſome of the gulls and merganſers. But ducks pull the down from their own breaſts to afford a warmer and more comfortable bed for their young. The auks, the guillemots, and the puffins or coulternebs, lay their eggs on the naked ſhelves of high rocks. The penguins, for the ſame purpoſe, dig large and deep holes under ground.

It is not unworthy of remark, that birds uniformly proportion the dimenſions of their neſts to the number and ſize of the young to be produced. Every ſpecies lays nearly a determined number of eggs. But, if one be each day abſtracted from the neſt, the bird continues to lay daily more till her number is completed. Dr Liſter, by this practice, made a ſwallow lay no leſs than nineteen eggs.

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* Willoughby’s Ornithology, pag. 215.

The habitations of *Inſects* are next to be conſidered. On this branch of the ſubject, we ſhall firſt give ſome examples of abodes conſtructed by ſolitary workers, and next of thoſe habitations which are executed by aſſociated numbers.

In ſeveral preceding parts of this work, and particularly in the chapter upon Inſtinct, the reader will find ſome inſtances of the ſkill and induſtry exhibited by inſects for the convenient lodging and protection of their young. Theſe it is unneceſſary to repeat. We ſhall therefore proceed to give ſome examples of a different kind.

There are ſeveral ſpecies of bees diſtinguiſhed by the appellation of *ſolitary*, becauſe they do not aſſociate to carry on any joint operations. Of this kind is the *maſon-bee*, ſo called becauſe it builds a habitation compoſed of ſand and mortar. The neſts of this bee are fixed to the walls of houſes, and, when finiſhed, have the appearance of irregular prominences ariſing from dirt or clay accidentally thrown againſt a wall or ſtone by the feet of horſes. Theſe prominencies are not ſo remarkable as to attract attention ; but, when the external coat is removed, their ſtructure is diſcovered to be truly admirable. The interior part conſiſts of an aſſemblage of different cells, each of which affords a convenient lodgement to a white worm, pretty ſimilar to thoſe produced by the honey-bee. Here they remain till they have undergone all their metamorphoſes. In conſtructing this neſt, which is a work of great labour and dexterity, the female is the ſole operator. She receives no aſſiſtance from the male. The manner in which the female maſon-bees build their neſts is the moſt curious branch of their hiſtory.

After chooſing a part of a wall on which ſhe is reſolved to fix an habitation for her future progeny, ſhe goes in queſt of proper materials. The neſt to be conſtructed muſt conſiſt of a ſpecies of mortar,

tar, of which ſand is the baſis. She knows, like human builders, that every kind of ſand is not equally proper for making good mortar. She goes, therefore, to a bed of ſand and ſelects, grain by grain, the kind which is beſt to anſwer her purpoſe. With her teeth, which are as large and as ſtrong as thoſe of the honey bee, ſhe examines and brings together ſeveral grains. But ſand alone will not make mortar. Recourſe muſt be had to a cement ſimilar to the ſlacked lime employed by maſons. Our bee is unacquainted with lime, but ſhe poſſeſſes an equivalent in her own body. From her mouth ſhe throws out a viſcid liquor, with which ſhe moiſtens the firſt grain pitched upon. To this grain ſhe cements a ſecond, which ſhe moiſtens in the ſame manner, and to the former two ſhe attaches a third, and ſo on, till ſhe has formed a maſs as large as the ſhot uſually employed to kill hares. This maſs ſhe carries off in her teeth to the place ſhe had choſen for erecting her neſt, and makes it the foundation of the firſt cell. In this manner ſhe labours inceſſantly till the whole cells are completed, a work which is generally accompliſhed in five or ſix days. All the cells are ſimilar, and nearly equal in dimenſions. Before they are covered, their figure reſembles that of a thimble. She never begins to make a ſecond till the firſt be finiſhed. Each cell is about an inch high, and nearly half an inch in diameter. But the labour of building is not the only one this female bee has to undergo. When a cell has been raiſed to one half or two thirds of its height, another occupation commences. She ſeems to know the quantity of food that will be neceſſary to nouriſh the young that is to proceed from the egg, from its excluſion till it acquires its full growth, and paſſes into the chryſalis ſtate. The food which is prepared for the ſupport of the young worm conſiſts of the farina or powder of flowers, diluted with honey, which forms a kind of pap. Before the cell is entirely finiſhed, the maſon-bee collects from the flowers, and depoſits in the cell, a large quantity of farina, and afterwards diſgorges upon it as much honey as dilutes it, and forms it into a kind of paſte, or ſyrup. When this operation is performed, ſhe completes her cell, and, after depoſiting an egg in it, covers the mouth of it with the ſame mortar ſhe uſes in building her neſt. The egg is now incloſed on all ſides in a walled habitation hermetically ſealed. A ſmall quantity of air, however, gets admiſſion to the worm, otherwiſe it could not exiſt. Reaumur diſcovered that air actually penetrated through this ſeemingly compact maſon-work.

As ſoon as the firſt cell is completed, the maſon-bee lays the foundation of another. In the ſame neſt ſhe often conſtructs ſeven or eight cells, and ſometimes only three or four. She places them near each other, but not in any regular order. This induſtrious animal, after all her cells are conſtructed, filled with proviſions, and ſealed, covers the whole with an envelope of the ſame mortar, which, when dry, is as hard as a ſtone. The neſt now is commonly of an oblong or roundiſh figure, and the external cover is compoſed of coarſer ſand than that of the cells. As the neſts are almoſt as durable as the walls on which they are placed, they are often, in the following ſeaſon, occupied and repaired by a ſtranger bee. Though incloſed with two hard walls, when the fly emerges from the chryſalis ſtate, it firſt gnaws with its teeth a paſſage through the wall that ſealed up the mouth of its cell, afterwards, with the ſame inſtruments, it pierces the ſtill ſtronger and more compact cover which inveſts the whole neſt; at laſt it eſcapes into the open air, and, if a female, in a ſhort time, conſtructs a neſt of the ſame kind with that which the mother had made. To all theſe facts, Du Hamel, Reaumur, and many other naturaliſts of credit and reputation, have been repeatedly eye-witneſſes.

From the hardneſs of the materials with which the maſon-bee conſtructs her neſt, from the induſtry and dexterity ſhe employs to protect her progeny from enemies of every kind, one ſhould naturally imagine that the young worms were in perfect ſafety, and that their caſtle was impregnable. But, notwithſtanding all theſe favourable precautions, the young of the maſon-bee are often devoured by the inſtinctive dexterity of certain ſpecies of four-winged inſects, diſtinguiſhed by the name of *ichneumon flies*. Theſe flies, when the maſon-bee has nearly completed a cell, and filled it with proviſions, depoſit their own eggs in her cell. After the eggs of the ichneumon flies are hatched, their worms devour not only the proviſions laid up by the maſon-bee, but even her progeny whom ſhe had laboured ſo hard, and with ſo much art and ingenuity, to protect. But the maſon-bee has an enemy ſtill more formidable. A certain fly employs the ſame ſtratagem of inſinuating an egg into one of her cells before it is completed. From this egg proceeds a ſtrong and rapacious worm, armed with prodigious fangs. The devaſtations of this worm are not confined to one cell. He often pierces through each cell in the neſt, and ſucceſſively devours both the maſon-worms, and the proviſions ſo anxiouſly laid up for their ſupport by the mother. This ſtranger worm is afterwards transformed into a fine beetle, who is enabled to pierce the neſt, and to make his eſcape.

The operations of another ſpecies of ſolitary bees, called *wood-piercers*, merit attention. Theſe bees are larger than the queens of the honey-bee. Their bodies are ſmooth, except the ſides, which are covered with hair. In the ſpring, they frequent gardens, and ſearch for rotten, or at leaſt dead wood, in order to make an habitation for their young. When a female of this ſpecies, for ſhe receives no aſſiſtance from the male, has ſelected a piece of wood, or a decayed tree, ſhe commences her labour by making a hole in it, which is generally directed toward the axis of the tree. When ſhe has advanced about half an inch, ſhe alters the direction of the hole, and conducts it nearly parallel to the axis of the wood. The ſize of her body requires that this hole ſhould have a conſiderable diameter. It is often ſo large as to admit the finger of a man, and it ſometimes extends from twelve to fifteen inches in length. If the thickneſs of the wood permits, ſhe makes three or four of theſe long holes in its interior part. M. de Reaumur found three of theſe parallel holes in an old eſpalier poſt. Their diameters exceeded half an inch. This labour, for a ſingle bee, is prodigious; but, in executing it, ſhe conſumes weeks, and even months.

Around the foot of a poſt or piece of wood where one of theſe bees are working, little heaps of timber-duſt are always found lying on the ground. Theſe heaps daily increaſe in magnitude, and the particles of duſt are as large as thoſe produced by a hand-ſaw. The two teeth with which the animal is provided are the only inſtruments ſhe employs in making ſuch conſiderable perforations. Each tooth conſiſts of a ſolid piece of ſhell, which in ſhape reſembles an auger. It is convex above, concave below, and terminates in a ſharp but ſtrong point.

Theſe long holes are deſigned for lodgings to the worms that are to proceed from the eggs which the bee is ſoon to depoſit in them. But, after the holes are finiſhed, her labour is by no means at an end. The eggs muſt not be mingled, or piled above each other. Every ſeparate worm muſt have a diſtinct appartment, without any communication with the others. Each long hole or tube, accordingly, is only the outer walls of a houſe which is to conſiſt of many chambers ranged one above another. A hole of about twelve inches in length ſhe divides into ten or twelve ſeparate appartments, each of which is about an inch high. The roof of the loweſt room is the floor of the ſecond, and ſo on to the uppermoſt. Each floor is about the thickneſs of a French crown. The floors or diviſions are compoſed of particles of wood cemented together by a glutinous ſubſtance from the animal's mouth. In making a floor, ſhe commences with gluing an annular plate of wood-duſt round the internal circumference of the cavity. To this plate ſhe attaches a ſecond, to the ſecond a third, and to the third a fourth, till the whole floor is completed. The undermoſt cell requires only a roof, and this roof is a floor to the ſecond, &c.

We have hitherto deſcribed the wonderful aſſiduity of this animal in conſtructing her cells. But this operation, though great, and ſeemingly ſuperior to the powers of a creature ſo ſmall, is not her only labour. Before roofing in the firſt cell, ſhe fills it with a paſte or pap, compoſed of the farina of flowers moiſtened with honey. The quantity of paſte is equal to the dimenſions of the cell, which is about an inch high, and half an inch in diameter. Into this paſte, which is to nouriſh the future worm, ſhe depoſits an egg. Immediately after this operation, ſhe begins to form a roof, which not only incloſes the firſt cell, but ſerves as a floor to the ſecond. The ſecond cell ſhe likewiſe fills with paſte, depoſits an egg, and then covers the whole with another roof. In this manner ſhe proceeds, till ſhe has divided the whole tube into ſeparate cells. A ſingle tube frequently contains from ten to a dozen of theſe cells. When the cells are all incloſed, the buſineſs of this laborious bee is finiſhed, and ſhe takes no more charge of her future progeny. The attention and ſolicitude beſtowed by many other animals, in rearing their young, are exerted after birth. But, in the wood-piercing bee, as well as in many other inſects, this inſtinctive attachment is reverſed. All her labours and all her cares are exerted before ſhe either ſees her offſpring, or knows that they are to exiſt. But, after the deſcription that has been given of her amazing operations, ſhe will not be conſidered as an unnatural mother. With aſtoniſhing induſtry and perſeverance, ſhe not only furniſhes her young with ſafe and convenient lodgings, but lays up for them ſtores of proviſions ſufficient to ſupport them till their final metamorphoſis into flies, when the new females perform the ſame almoſt incredible operations for the protection and ſuſtenance of their own offspring. When the young worm is hatched, it has ſcarcely ſufficient ſpace to turn itſelf in the cell, which is almoſt entirely filled with the pappy ſubſtance formerly mentioned. But, as this ſubſtance is gradually devoured by the worm, the ſpace in the cell neceſſarily enlarges in proportion to the growth and magnitude of the animal.

We are informed by M. de Reaumur *, that M. Pitot furniſhed him with a piece of wood, not exceeding an inch and a half in diameter, which contained the cells of a wood-piercing bee. He cut off as much of the wood as was ſufficient to expoſe two of the cells to view, in each of which was a worm. The aperture he had made, to prevent the injuries of the air, he cloſed, by paſting on it a bit of glaſs. The cells were then almoſt entirely filled with paſte. The two worms were exceedingly ſmall, and, of courſe, occupied but little ſpace between the walls of the cells and the maſs of paſte. As the animals increaſed in ſize, the paſte daily diminiſhed. He began to obſerve them on the 12th day of June; and, on the 27th of the ſame month, the paſte in each cell was nearly conſumed, and the worm, folded in two, occupied the greater part of its habitation. On the 2d of July, the proviſions of both worms were entirely exhauſted; and, beſide the worms themſelves, there remained in the cells only a few ſmall, black, oblong grains of excrement. The five or ſix following days they faſted, which ſeemed to be a neceſſary abſtinence, during which they were greatly agitated. They often bended their bodies, and elevated and depreſſed their heads. Theſe movements were preparatory to the great change the animals were about

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* Tom. 11. pag. 58. 12mo edit.

about to undergo. Between the 7th and 8th of the ſame month, they threw off their ſkins, and were metamorphoſed into nymphs. On the 30th of July, theſe nymphs were transformed into flies ſimilar to their parents. In a range of cells, the worms are of different ages, and, of courſe, of different ſizes. Thoſe in the lower cells are older than thoſe in the ſuperior; becauſe, after the bee has filled with paſte and encloſed its firſt cell, a conſiderable time is requiſite to collect proviſions, and to form partitions for every ſucceſſive and ſuperior cell. The former, therefore, muſt be transformed into nymphs and flies before the latter. Theſe circumſtances are apparently foreſeen by the common mother; for, if the undermoſt worm, which is oldeſt, and ſooneſt transformed, were to force its way upward, which it could eaſily do, it would not only diſturb, but infallibly deſtroy all thoſe lodged in the ſuperior cells. But Nature has wiſely prevented this devaſtation; for the head of the nymph, and conſequently of the fly, is always placed in a downward direction. Its firſt inſtinctive movements muſt, therefore, be in the ſame direction. That the young flies may eſcape from their reſpective cells, the mother digs a hole at the bottom of the long tube, which makes a communication with the undermoſt cell and the open air. Sometimes a ſimilar paſſage is made near the middle of the tube. By this contrivance, as all the flies inſtinctively endeavour to cut their way downward, they find an eaſy and convenient paſſage; for they have only to pierce the floor of their cells, which they readily perform with their teeth.

Another ſmall ſpecies of ſolitary bees dig holes in the earth to make a convenient habitation for their young. Their neſts are compoſed of cylindrical cells fixed to one another, and each of them, in figure, reſembles a thimble. Their bottom, of courſe, is convex and rounded. The bottom of the ſecond is inſerted into the entry of the firſt; and the entry of the ſecond receives the bottom of the third. They are not all of the ſame length. Some of them are five lines long, others only four, and their diameters ſeldom exceed two lines. Sometimes only two of theſe cells are joined together; and, at other times, we find three or four, which form a kind of cylinder. This cylinder is compoſed of alternate bands of two different colours: Thoſe of the narroweſt, at the juncture of two cells, are white, and thoſe of the broadeſt are of a reddiſh brown. The cells conſiſt of a number of fine membranes, formed of a glutinous and tranſparent ſubſtance from the animal's mouth. Each cell our bee fills with the farina of flowers diluted with honey, and in this paſte ſhe depoſits an egg. She then covers the cell, by gluing to its mouth a fine cellular ſubſtance taken from the leaves of ſome plant; and in this manner ſhe proceeds till her cylindrical neſt is completed. The worms which are hatched from the eggs feed upon the paſte, ſo carefully laid up for them by the mother, till they are transformed into flies ſimilar to their parents.

Among waſps, as well as bees, there are ſolitary ſpecies, which carry on no joint operations. Theſe ſolitary waſps are not leſs ingenious in conſtructing proper habitations for their young, nor leſs provident in laying up for them a ſtore of nouriſhment ſufficient to ſupport them till they are transformed into flies, or have become perfect animals *. But, to give a detailed deſcription of their operations would lead us into a prolixity of which the plan of our work does not admit.

On this ſubject, however, it cannot eſcape obſervation, that all the ſagacity and laborious induſtry exerted in the various inſtances of animal architecture above deſcribed, have one uniform tendency. They are all deſigned for the multiplication, protection, and nouriſhment

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* See page 128.

riſhment of offspring. But many of them are ſo artful, and require ſuch perſevering labour, that the human mind is bewildered when it attempts to account for them. If we attend to the operations of quadrupeds, of birds, and of inſects, moſt of them, like pregnant women, ſeem to know, from their own feelings, and foreſight, not only their preſent condition, but what futurity is to produce. To ſolve this problem, recourſe has been had by Des Cartes, by Buffon, and by other philoſophers, to conformation of body and mechanical impulſe. Their reaſonings, however, though often ingenious, involve the ſubject in tenfold obſcurity. We can hardly ſuppoſe that the animals actually foreſee what is to happen, becauſe, at firſt, they have not had even the aid of experience; and, particularly in ſome of the inſect tribes, the parents are dead before their young are produced. Pure inſtincts of this kind, therefore, muſt be referred to another ſource. In a chain of reaſoning concerning the operations of Nature, ſuch is the conſtitution of our minds, that we are under the neceſſity of reſorting to an ultimate cauſe. What that cauſe is, it is the higheſt preſumption in man to pretend to define. But, though we muſt forever remain ignorant of the cauſe, we are enabled to trace, and even to underſtand, partially, ſome of the effects; and, from theſe effects, we perceive the moſt conſummate wiſdom, the moſt elegant and perfect contrivances to accompliſh the multifarious and wonderful intentions of Nature. In contemplating the operations of animals, from man down to the ſeemingly moſt contemptible inſect, we are neceſſarily compelled to refer them to pure inſtincts, or original qualities of mind, variegated by Nature according as the neceſſities, preſervation, and continuation of the different ſpecies require. Let any man try to proceed a ſtep farther, and, however he may deceive himſelf, and flatter his own vanity, he muſt find, at laſt, that he is clouded in obſcurity, and that men who have a more correct and unprejudiſed mode of thinking will brand him with abſurdity, and of acting in direct oppoſition to the conſtitution and frame of the human mind.

I ſhall now give ſome examples of the operations of aſſociating inſects, who conſtruct habitations by exerting a common and a mutual labour.

The ſkill and dexterity of the *honey-bees*, diſplayed in the conſtruction of their combs or neſts, have at all times called forth the admiration of mankind. They are compoſed of cells regularly applied to each others ſides. Theſe cells are uniform hexagons or ſix-ſided figures. In a bee-hive, every part is arranged with ſuch ſymmetry, and ſo finely finiſhed, that, if limited to the ſame materials, the moſt expert workman would find himſelf unqualified to conſtruct a ſimilar habitation, or rather a ſimilar city.

Moſt Natural Hiſtorians have celebrated bees for their wiſdom, for the perfection and harmony of their republican government, and for their perſevering induſtry and wonderful oeconomy. All theſe ſplendid talents, however, the late ingenious Count de Buffon has endeavoured to perſuade us, are only reſults of pure mechaniſm. But this is not the proper place to enter into a diſcuſſion of this point. It will fall more naturally to be treated of when we come to deſcribe the ſocieties eſtabliſhed among different gregarious animals. We ſhall therefore, at preſent, confine ourſelves chiefly to the mode in which bees conſtruct their habitations.

In the formation of their combs, bees ſeem to reſolve a problem which would not be a little puzzling to ſome geometers, namely, A quantity of wax being given, to make of it equal and ſimilar cells of a determined capacity, but of the largeſt ſize in proportion to the quantity of matter employed, and diſpoſed in ſuch a manner as to occupy in the hive the leaſt poſſible ſpace. Every part of this problem is completely executed by the bees. By applying hexagonal cells to each other's ſides, no void ſpaces are left between them; and, though the ſame end might be accompliſhed by other figures, yet they would neceſſarily require a greater quantity of wax. Beſides, hexagonal cells are better fitted to receive the cylindrical bodies of theſe inſects. A comb conſiſts of two ſtrata of cells applied to each other's ends. This arrangement both ſaves room in the hive, and gives a double entry into the cells of which the comb is compoſed. As a farther ſaving of wax, and preventing void ſpaces, the baſes of the cells in one ſtratum of a comb ſerve for baſes to the oppoſite ſtratum. In a word, the more minutely the conſtruction of theſe cells are examined, the more will the admiration of the obſerver be excited. The walls of the cells are ſo extremely thin, that their mouths would be in danger of ſuffering by the frequent entering and iſſuing of the bees. To prevent this diſaſter, they make a kind of ring round the margin of each cell, and this ring is three or four times thicker than the walls.

It is difficult to perceive, even with the aſſiſtance of glaſs-hives, the manner in which bees operate when conſtructing their cells. They are ſo eager to afford mutual aſſiſtance, and, for this purpoſe, ſo many of them crowd together, and are perpetually ſucceeding each other, that their individual operations can ſeldom be diſtinctly obſerved. It has, however, been plainly diſcovered, that their two teeth are the only inſtruments they employ in modelling and poliſhing the wax. With a little patience and attention, we perceive cells juſt begun: We likewiſe remark the quickneſs with which a bee moves its teeth againſt a ſmall portion of the cell. This portion the animal, by repeated ſtrokes on each ſide, ſmooths, renders compact, and reduces to a proper thinneſs of conſiſtence. While ſome of the hive are lengthening their hexagonal tubes, others are laying

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the foundations of new ones. In certain circumſtances, when extremely hurried, they do not complete their new cells, but leave them imperfect till they have begun a number ſufficient for their preſent exigencies. When a bee puts its head a little way into a cell, we eaſily perceive it ſcraping the walls with the points of its teeth, in order to detach ſuch uſeleſs and irregular fragments as may have been left in the work. Of theſe fragments the bee forms a ball about the ſize of a pin-head, comes out of the cell, and carries this wax to another part of the work where it is needed. It no ſooner leaves the cell than it is ſucceeded by another bee, which performs the ſame office, and in this manner the work is ſucceſſively carried on till the cell is completely poliſhed.

The cells of bees are deſigned for different purpoſes. Some of them are employed for the accumulation and preſervation of honey. In others, the female depoſits her eggs, and from theſe eggs worms are hatched, which remain in the cells till their final transformation into flies. The drones or males are larger than the common or working bees; and the queen, or mother of the hive, is much larger than either. A cell deſtined for the lodgement of a male or female worm muſt, therefore, be conſiderably larger than the cells of the ſmaller working bees. The number of cells deſtined for the reception of the working bees far exceeds thoſe in which the males are lodged. The honey-cells are always made deeper and more capacious than the others. When the honey collected is ſo abundant that the veſſels cannot contain it, the bees lengthen, and of courſe deepen the honey-cells.

Their mode of working, and the diſpoſition and diviſion of their labour, when put into an empty hive, do much honour to the ſagacity of bees. They immediately begin to lay the foundations of their combs, which they execute with ſurpriſing quickneſs and alacrity.

crity. Soon after they begin to conſtruct one comb, they divide into two or three companies, each of which, in different parts of the hive, is occupied with the ſame operations. By this diviſion of labour, a greater number of bees have an opportunity of being employed at the ſame time, and, conſequently, the common work is ſooner finiſhed. The combs are generally arranged in a direction parallel to each other. An interval or ſtreet between the combs is always left, that the bees may have a free paſſage, and an eaſy communication with the different combs in the hive. Theſe ſtreets are juſt wide enough to allow two bees to paſs one another. Beſide theſe parallel ſtreets, to ſhorten their journey when working, they leave ſeveral round croſs paſſages, which are always covered.

Hitherto we have chiefly taken notice of the manner in which bees conſtruct and poliſh their cells, without treating of the materials they employ. We have not marked the difference between the crude matter collected from flowers and the true wax. Every body knows that bees carry into their hives, by means of their hind thighs, great quantities of the farina or duſt of flowers. After many experiments made by Reaumur, with a view to diſcover whether this duſt contained real wax, he was obliged to acknowledge, that he could never find that wax formed any part of its compoſition. He at length diſcovered, that wax was not a ſubſtance produced by the mixture of farina with any glutinous ſubſtance, nor by trituration, or any mechanical operation. By long and attentive obſervation, he found that the bees actually eat the farina which they ſo induſtriouſly collect; and that this farina, by an animal proceſs, is converted into wax. This digeſtive proceſs, which is neceſſary to the formation of wax, is carried on in the ſecond ſtomach, and perhaps in the inteſtines of bees. After knowing the place where this operation is performed, chymiſts will probably allow, that it is equally difficult to make real wax with the farina of flowers, as to make chyle with animal or vegetable ſubſtances, a work which is daily executed by our own ſtomach and inteſtines, and by thoſe of other animals. Reaumur likewiſe diſcovered, that all the cells in a hive were not deſtined for the reception of honey, and for depoſiting the eggs of the female; but that ſome of them were employed as receptacles for the farina of flowers, a ſpecies of food that bees find neceſſary for the formation of wax, which is the great baſis and raw material of all their curious operations. When a bee comes to the hive with its thighs filled with farina, it is often met near the entrance by ſome of its companions, who firſt take off the load, and then devour the proviſions ſo kindly brought to them. But, when none of the bees employed in the hive are hungry for this ſpecies of food, the carriers of the farina depoſit their loads in cells prepared for that purpoſe. To theſe cells the bees reſort, when the weather is ſo bad that they cannot venture to go to the fields in queſt of freſh proviſions. The carrying bees, however, commonly enter the hive loaded with farina. They walk along the combs beating and making a noiſe with their wings. By theſe movements they ſeem to announce their arrival to their companions. No ſooner has a loaded bee made theſe movements, than three or four of thoſe within leave their work, come up to it, and firſt take off its load, and then eat the materials it has brought. As a farther evidence that the bees actually eat the farina of flowers, when the ſtomach and inteſtines are laid open, they are often found to be filled with this duſt, the grains of which, when examined by the microſcope, have the exact figure, colour, and conſiſtence of farina, taken from the antherae of particular flowers. After the farina is digeſted, and converted into wax, the bees poſſeſs the power of bringing it from their ſtomachs to their mouths. The inſtrument they employ in furniſhing materials for conſtructing their waxen cells is their tongue. This tongue is ſituated below the two teeth or fangs. When at work, the tongue may be ſeen by the aſſiſtance of a lens and a glaſs-hive. It is then in perpetual motion, and its motions are extremely rapid. Its figure continually varies. Sometimes it is more ſharp, at others it is flatter, and ſometimes it is more or leſs concave, and partly covered with a moiſt paſte or wax. By the different movements of its tongue the bee continues to ſupply freſh wax to the two teeth, which are employed in raiſing and faſhioning the walls of its cell, till they have acquired a ſufficient height. As ſoon as the moiſt paſte or wax dries, which it does almoſt inſtantaneouſly, it then aſſumes all the appearances and qualities of common wax. There is a ſtill ſtronger proof that wax is the reſult of an animal proceſs. When bees are removed into a new hive, and cloſely confined from the morning to the evening, if the hive chances to pleaſe them, in the courſe of this day ſeveral waxen cells will be formed, without the poſſibility of a ſingle bee's having had acceſs to the fields. Beſides, the rude materials, or the farina of plants, carried into the hive, are of various colours. The farina of ſome plants employed by the bees is whitiſh; in others it is of a fine yellow colour; in others it is almoſt entirely red; and in others it is green. The combs conſtructed with theſe differently coloured materials are, however, uniformly of the ſame colour. Every comb, eſpecially when it is newly made, is of a pure white colour, which is more or leſs tarniſhed by age, the operation of the air, or by other accidental circumſtances. To bleach wax, therefore, requires only the art of extracting ſuch foreign bodies as may have inſinuated themſelves into its ſubſtance and changed its original colour.

Bees, from the nature of their conſtitution, require a warm habitation. They are likewiſe extremely ſolicitous to prevent inſects of any kind from getting admittance into their hives. To accompliſh both theſe purpoſes, when they take poſſeſſion of a new hive, they carefully examine every part of it, and, if they diſcover any ſmall holes or chinks, they immediately paſte them firmly up with a reſinous ſubſtance which differs conſiderably from wax. This ſubſtance was not unknown to the ancients. Pliny mentions it under the name of *propolis*, or bee-glue. Bees uſe the propolis for rendering their hives more cloſe and perfect, in preference to wax, becauſe the former is more durable, and more powerfully reſiſts the viciſſitudes of weather than the latter. This glue is not, like wax, procured by an animal proceſs. The bees collect it from different trees, as the poplars, the birches, and the willows. It is a complete production of Nature, and requires no addition or manufacture from the animals by which it is employed. After a bee has procured a quantity ſufficient to fill the cavities in its two hind thighs, it repairs to the hive. Two of its companions inſtantly draw out the propolis, and apply it to fill up ſuch chinks, holes, or other deficiencies, as they find in their habitation. But this is not the only uſe to which bees apply the propolis. They are extremely ſolicitous to remove ſuch inſects or foreign bodies as happen to get admiſſion into the hive. When ſo light as not to exceed their powers, they firſt kill the inſect with their ſtings, and then drag it out with their teeth. But it ſometimes happens that an ill-fated ſnail creeps into the hive. It is no ſooner perceived than it is attacked on all ſides and ſtung to death. But how are the bees to carry out a burden of ſuch weight? This labour they know would be in vain. They are perhaps apprehenſive that a body ſo large would diffuſe, in the courſe of its putrefaction, a diſagreeable or noxious odour through the hive. To prevent ſuch hurtful conſequences, immediately after the animal's death, they embalm it, by covering every part of its body with propolis, through which no effluvia can eſcape. When a ſnail with a ſhell gets entrance, to diſpoſe of it gives much leſs trouble and expence to the bees. As ſoon as this kind of ſnail receives the firſt wound from a ſting, it naturally retires within its ſhell. In this caſe, the bees, inſtead of paſting it all over with propolis, content themſelves with gluing all round the margin of the ſhell, which is ſufficient to render the animal forever immoveably fixed.

But propolis, and the materials for making wax, are not the only ſubſtances theſe induſtrious animals have to collect. As formerly remarked, beſide the whole winter, there are many days in ſummer in which the bees are prevented by the weather from going abroad in queſt of proviſions. They are, therefore, under the neceſſity of collecting, and amaſſing in cells deſtined for that purpoſe, large quantities of honey. This ſweet and balſamic liquor they extract, by means of their proboſcis or trunk, from the nectariferous glands of flowers. The trunk of a bee is a kind of rough cartilaginous tongue. After collecting a few ſmall drops of honey, the animal with its proboſcis conveys them to its mouth and ſwallows them. From the oeſophagus or gullet, it paſſes into the firſt ſtomach, which is more or leſs ſwelled in proportion to the quantity of honey it contains. When empty, it has the appearance of a fine white thread: But, when filled with honey, it aſſumes the figure of an oblong bladder, the membrane of which is ſo thin and tranſparent, that it allows the colour of the liquor it contains to be diſtinctly ſeen. This bladder is well known to children who live in the country. They cruelly amuſe themſelves with catching bees, and tearing them aſunder, in order to ſuck the honey. A ſingle flower furniſhes but a ſmall quantity of honey. The bees are, therefore, obliged to fly from one flower to another till they fill their firſt ſtomachs. When they have accompliſhed this purpoſe, they return directly to the hive, and diſgorge in a cell the whole honey they have collected. It not unfrequently happens, however, that, when on its way to the hive, it is accoſted by a hungry companion. How the one can communicate its neceſſity to the other, it is perhaps impoſſible to diſcover. But the fact is certain, that, when two bees meet in this ſituation, they mutually ſtop, and the one whoſe ſtomach is full of honey extends its trunk, opens its mouth, which lies a little beyond the teeth, and, like ruminating animals, forces up the honey into that cavity. The hungry bee knows how to take advantage of this hoſpitable invitation. With the point of its trunk it ſucks the honey from the other's mouth. When not ſtopped on the road, the bee proceeds to the hive, and in the ſame manner offers its honey to thoſe who are at work, as if it meant to prevent the neceſſity of quitting their labour in order to go in queſt of food. In bad weather, the bees feed upon the honey laid up in open cells; but they never touch theſe reſervoirs when their companions are enabled to ſupply them with freſh honey from the fields. But the mouths of thoſe cells which are deſtined for preſerving honey during winter, they always cover with a lid or thin plate of wax.

Though not ſtrictly connected with the preſent ſubject, we cannot refrain from giving ſome account of the ingenious Mr Debraw's diſcoveries concerning the ſex of bees, and the manner in which their ſpecies is multiplied *. It was almoſt univerſally believed, both by ancients and moderns, that bees, like other animals, propagated by an actual intercourſe of the male and female, though it never could be perceived by the moſt attentive obſervers. Pliny remarks, that *apium coitus viſus eſt nunquam;* and even the indefatigable Reaumur, notwithſtanding the many minute reſearches and experiments he made concerning every part of the oeconomy of bees, and though he repreſents the mother, or queen-bee, as a perfect Meſſalina, could never detect an actual intercourſe. From this ſingular circumſtance, Maraldi, in his obſervations upon bees †, conjectured that the eggs of bees, like thoſe of fiſhes, were impregnated after they were depoſited in the cells by the mother. He was farther confirmed in this opinion, by uniformly obſerving that a whitiſh liquid ſubſtance ſurrounded each egg which turned out to be fertile; but that thoſe eggs round which no ſuch ſubſtance was to be found were always barren. The working bees, or thoſe which collect from flowers the materials of wax, have generally been conſidered as belonging to neither ſex. But Mr Schirach, a German Naturaliſt, in his *Hiſtory of the Queen of the Bees*, maintains, that all the common bees are females in a diſguiſed or barren ſtate; that the organs which diſtinguiſh the ſex, and particularly the ovaria, are either obliterated, or, on account of their minuteneſs, have not hitherto been diſcovered; that, in the early period of its exiſtence, every one of theſe bees is capable of becoming a queen-bee, if the community chooſe to nurſe it in a certain manner, and to raiſe it to that diſtinguiſhed rank; and that the queen-bee lays only two kinds of eggs, namely, thoſe that are to produce drones or males, and thoſe from which the working bees are to proceed.

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* See Philoſophical Tranſactions, ann. 1777, Part I. page 15.

† Hiſt. de l'Acad. de Scien. ann. 1712.

The conjecture of Maraldi concerning the impregnation of the eggs after they are depoſited in the cells, as well as the obſervations of Mr Schirach concerning the ſex of the working bees, have been completely verified by the experiments of Mr Debraw. Both Maraldi and Reaumur had long ago diſcovered, that, in every hive, beſide the large drones, there are males or drones as ſmall as the working bees. By means of glaſs-hives, Mr Debraw obſerved, that the queen-bee begins to depoſit her eggs in the cells on the fourth or fifth day after the bees begin to work. On the firſt or ſecond day after the eggs are placed in the cells, he perceived ſeveral bees ſinking the poſterior parts of their bodies into each cell, where they continued but a ſhort time. After they had retired, he ſaw plainly with the naked eye a ſmall quantity of whitiſh liquor left in the bottom of each cell that contained an egg. Next day he found that this liquor was abſorbed into the egg, which, on the fourth day, is hatched. When the worms eſcape from the eggs, they are fed for eight or ten days with honey by the working bees. After that period they ſhut up the mouths of the cells, where the worms continue incloſed for ten days more, during which time they undergo their different transformations.

'I immerſed,' ſays Mr Debraw, 'all the bees in water; and, 'when they appeared to be in a ſenſeleſs ſtate, I gently preſſed every 'one of them between my fingers, in order to diſtinguiſh thoſe 'armed with ſtings from thoſe that had none, which laſt I might 'ſuſpect to be males. Of theſe I found ſixty-ſeven, exactly of the 'ſize of common bees, yielding a little whitiſh liquor on being preſ'ſed between the fingers. I killed every one, and replaced the 'ſwarm in a glaſs-hive, where they immediately applied again to 'the work of making cells; and, on the fourth or fifth day, very 'early in the morning, I had the pleaſure to ſee the queen-bee de'poſiting her eggs in thoſe cells, which ſhe did by placing the po'ſterior part of her body in each of them. I continued to watch 'moſt part of the enſuing days, but could diſcover nothing of what 'I had ſeen before. The eggs, after the fourth day, inſtead of 'changing in the manner of caterpillars, were found in the ſame 'ſtate they were in the firſt day.' The next day about noon, the whole ſwarm forſook the hive, probably becauſe the animals perceived, that, without the aſſiſtance of males, they were unqualified to multiply their ſpecies. To ſhow the neceſſity of the eggs being fecundated by the male influence, Mr Debraw relates an experiment ſtill more deciſive.

'I took,' ſays he, 'the brood-comb, which, as I obſerved before, 'had not been impregnated; I divided it into two parts; one I 'placed under a glaſs-bell, No. 1. with honey-comb for the bees 'food; I took care to leave a queen, but no drones, among the com'mon

‘ mon bees I confined in it. The other piece of brood-comb I placed ‘ under another glaſs-bell, No. 2. with a few drones, a queen, and ‘ a number of common bees proportioned to the ſize of the glaſs. ‘ The reſult was, that, in the glaſs No. 1. no impregnation happened; the eggs remained in the ſame ſtate they were in when put into the glaſs; and, upon giving the bees their liberty on the ſeventh ‘ day, they all flew away, as was found to be the caſe in the former ‘ experiment: Whereas, in the glaſs No. 2. I ſaw, the very day after the bees had been put under it, the impregnation of the eggs ‘ by the drones in every cell containing eggs; the bees did not leave ‘ their hive on receiving their liberty; and, in the courſe of twenty ‘ days, every egg underwent all the above mentioned neceſſary ‘ changes, and formed a pretty numerous young colony, in which I ‘ was not a little ſtartled to find *two* queens.’

The appearance of a new queen in a hive where there was no large or royal cell, made Mr Debraw conjecture that the bees are capable, by ſome particular means, of transforming a common ſubject into a queen. To aſcertain the truth of this conjecture, he provided himſelf with four glaſs-hives, into each of which he put a piece of brood-comb taken from an old hive. Theſe pieces of brood-comb contained eggs, worms, and nymphs. In each hive he confined a ſufficient number of common bees, and ſome drones or males, but took care that there ſhould be no queen.

‘ The bees,’ Mr Debraw remarks, ‘ finding themſelves without a ‘ queen, made a ſtrange buzzing noiſe, which laſted near two days, ‘ at the end of which they ſettled, and betook themſelves to work. ‘ On the fourth day, I perceived in each hive the beginning of a ‘ royal cell, *a certain indication that one of the incloſed worms would* ‘ *ſoon be converted into a queen.* The conſtruction of the royal cell ‘ being nearly accompliſhed, I ventured to leave an opening for the 'bees to get out, and found that they returned as regularly as they 'do in common hives, and ſhewed no inclination to leave their ha'bitation. But, to be brief, at the end of twenty days, I obſerved 'four young queens among the new progeny.'

To theſe experiments of Mr Debraw, it was objected, that the queen-bee, beſide the eggs which ſhe depoſits in the royal cells, might likewiſe have laid royal or female eggs in the common cells; and that the pieces of brood-comb, ſo ſucceſsfully employed in his experiments for the production of a queen, had always happened to contain one of theſe royal eggs, or rather one of the worms proceeding from them. But this objection was afterwards removed by many other accurate experiments, the reſults of which were uniformly the ſame; and the objectors to Mr Debraw's diſcovery candidly admit, that, when the community ſtands in need of a queen, the working-bees poſſeſs the power of raiſing a common ſubject to the throne; and that every worm of the hive is capable, under a certain courſe of management, of becoming the mother of a numerous progeny. This metamorphoſis ſeems to be chiefly accompliſhed by a peculiar nouriſhment carefully adminiſtered to the worm by the working-bees, by which, and perhaps by other unknown means, the female organs, the germs of which previouſly exiſted in the embryo, are expanded, and all thoſe differences in form and ſize, that ſo remarkably diſtinguiſh the queen from the working-bees, are produced.

It is always a fortunate circumſtance when diſcoveries, which at firſt ſeem calculated ſolely to gratify curioſity, are capable of being turned to the advantage of ſociety. Mr Debraw, accordingly, has not failed to point out the advantages that may be derived from his reſearches into the oeconomy and nature of bees. By his diſcovery, we are taught an eaſy mode of multiplying, without end, ſwarms, or new colonies, of theſe uſeful inſects. Beſide the great increaſe of honey, if this diſcovery were ſufficiently attended to, conſiderable ſums annually expended in importing wax into this kingdom from the Continent might be ſaved. The practice of this new art, Mr Schirach informs us, has already extended itſelf through Upper Luſatia, the Palatinate, Bohemia, Bavaria, Sileſia, and Poland. In ſome of theſe countries, it has excited the attention, and acquired the patronage, of government. The Empreſs of Ruſſia, who never loſes ſight of a ſingle article by which the induſtry, and, of courſe, the happineſs of her ſubjects can be augmented, has ſent a proper perſon to Klein Bautzen to be inſtructed in the general principles, and to learn all the minutiae of this new and important art.

Waſps, like the bees, aſſociate in great numbers, and conſtruct, with much dexterity and ſkill, a common habitation. There are many ſpecies of waſps, ſome of which unite into ſocieties, and others ſpend their lives in perfect ſolitude. But, in this place, we ſhall confine our attention to the operations of the common aſſociating waſp, an inſect ſo well known, even to children, that it requires no deſcription. Though bees, as well as waſps, are armed with a ſting, yet the former may be regarded as a placid and harmleſs race. Bees are continually occupied with their own labours. Their chief care is to defend themſelves; and they never take nouriſhment at the expence of any other animal. Waſps, on the contrary, are ferocious animals, who live entirely on rapine and deſtruction. They kill and devour every inſect that is inferior to them in ſtrength. But, though warlike and rapacious in their general manners, they are poliſhed and peaceable among themſelves. To their young they diſcover the greateſt tenderneſs and affection. For their protection and conveniency no labour is ſpared; and the habitations they conſtruct do honour to their patience, addreſs, and ſagacity. Their architecture, like that of the honey-bee, is ſingular, and worthy of admiration; but the materials employed furniſh neither honey nor wax. Impelled by an inſtinctive love of poſterity, they, with great labour, ſkill, and aſſiduity, conſtruct combs, which are likewiſe compoſed of hexagonal or ſix-ſided cells. Though theſe cells are not made of wax, they are equally proper for the reception of eggs, and for affording convenient habitations to the worms which proceed from them till their transformation into waſps.

In general, the cells of the waſps are formed of a kind of paper, which, with great dexterity, is fabricated by the animals themſelves. The number of combs and cells in a waſp's neſt is always proportioned to the number of individuals aſſociated. Different ſpecies chooſe different ſituations for building their neſts. Some expoſe their habitations to all the injuries of the air; others prefer the trunks of decayed trees; and others, as the common kind, of which we are principally treating, conceal their neſts under ground. The hole which leads to a waſp's neſt is about an inch in diameter. This hole is a kind of gallery mined by the waſps, is ſeldom in a ſtraight line, and varies in length from half a foot to two feet, according to the diſtance of the neſt from the ſurface of the ground. When expoſed to view, the whole neſt appears to be of a roundiſh form, and ſometimes about twelve or fourteen inches in diameter. It is ſtrongly fortified all round with walls or layers of paper, the ſurface of which is rough and irregular. In theſe walls, or rather in this external covering, two holes are left for paſſages to the combs. The waſps uniformly enter the neſt by one hole, and go out by the other, which prevents any confuſion or interruption to their common labours.

We are now arrived at the gates of this ſubterraneous city, which, though ſmall, is extremely populous. Upon removing the external covering, we perceive that the whole interior part conſiſts of ſeveral ſtoreys or floors of combs, which are parallel to each other, and nearly in a horizontal poſition. Every ſtorey is compoſed of a numerous aſſemblage of hexagonal cells, very regularly conſtructed with a matter reſembling aſh-coloured paper. Theſe cells contain neither wax nor honey, but are ſolely deſtined for containing the eggs, the worms which are hatched from them, the nymphs, and the young waſps till they are able to fly. Waſps neſts are not always compoſed of an equal number of combs. They ſometimes conſiſt of fifteen, and ſometimes of eleven only. The combs are of various diameters. The firſt, or uppermoſt, is often only two inches in diameter, while thoſe of the middle ſometimes exceed a foot. The loweſt are alſo much ſmaller than the middle ones. All theſe combs, like ſo many floors or ſtoreys ranged parallelly above each other, afford lodging to prodigious numbers of inhabitants. Reaumur computed, from the number of cells in a given portion of comb, that, in a medium ſized neſt, there were at leaſt 10,000 cells. This calculation gives an idea of the aſtoniſhing prolific powers of theſe inſects, and of the vaſt numbers of individuals produced in a ſingle ſeaſon from one neſt; for every cell ſerves as a lodging to no leſs than three generations. Hence a moderately ſized neſt gives birth annually to 30,000 young waſps.

The different ſtoreys of combs are always about half an inch high, which leaves free paſſages to the waſps from one part of the neſt to another. Theſe intervals are ſo ſpacious, that, in proportion to the bulk of the animals, they may be compared to great halls, or broad ſtreets. Each of the larger combs is ſupported by about fifty pillars, which, at the ſame time, give ſolidity to the fabric, and greatly ornament the whole neſt. The leſſer combs are ſupported by the ſame ingenious contrivance. Theſe pillars are coarſe, and of a roundiſh form. Their baſes and capitals, however, are much larger in diameter than towards the middle. By the one end they are attached to the ſuperior comb, and by the other to the inferior. Thus between two combs there is always a ſpecies of ruſtic colonade. The waſps begin at the top and build downward. The uppermoſt and ſmalleſt comb is firſt conſtructed. It is attached to the ſuperior part of the external covering. The ſecond comb is fixed to the bottom of the firſt; and in this manner the animals proceed till the whole operation is completed. The connecting pillars are compoſed of the ſame kind of paper as the reſt of the neſt. To allow the waſps entries into the void ſpaces, roads are left between the combs and the external envelope or covering.

Having given a general idea of this curious edifice, it is next natural to inquire how the waſps build, and how they employ themſelves in their abodes. But, as all theſe myſteries are performed under the earth, it required much induſtry and attention to diſcover them. By the ingenuity and perſeverance of M. de Reaumur, however, we are enabled to explain ſome parts of their internal oeconomy and manners. This indefatigable naturaliſt contrived to make waſps, like the honey-bees, lodge and work in glaſs-hives. In this operation he was greatly aſſiſted by the ardent affection which theſe animals have to their offspring; for he found, that, though the neſt was cut in different directions, and though it was expoſed to the light, the waſps never deſerted it, nor relaxed in their attention to their young. When placed in a glaſs-hive, they are perfectly peaceable, and never attack the obſerver, if he calmly contemplates their operations; for, naturally, they do not ſting, unleſs they are irritated.

Immediately after a waſp's neſt has been tranſported from its natural ſituation, and covered with a glaſs-hive, the firſt operation of the inſects is to repair the injuries it has ſuffered. With wonderful activity they carry off all the earth and foreign bodies that may have accidentally been conveyed into the hive. Some of them occupy

themſelves

themſelves fixing the neſt to the top and ſides of the hive by pillars of paper ſimilar to thoſe which ſupport the different ſtories or ſtrata of combs; others repair the breaches it has ſuſtained; and others fortify it by augmenting conſiderably the thickneſs of its external cover. This external envelope is an operation peculiar to waſps. Its conſtruction requires great labour; for it frequently exceeds an inch and a half in thickneſs, and is compoſed of a number of ſtrata or layers as thin as paper, between each of which there is a void ſpace. This cover is a kind of box for incloſing the combs, and defending them from the rain which occaſionally penetrates the earth. For this purpoſe it is admirably adapted. If it were one ſolid maſs, the contact of water would penetrate the whole, and reach the combs. But, to prevent this fatal effect, the animals leave conſiderable vacuities between each vaulted layer, which are generally fifteen or ſixteen in number. By this ingenious piece of architecture, one or two layers may be moiſtened with water, while the others are not in the leaſt affected.

The materials employed by waſps in the conſtruction of their neſts are very different from thoſe made uſe of by the honey-bee. Inſtead of collecting the farina of flowers, and digeſting it into wax, the waſps gnaw with their two fangs, which are ſtrong and ſerrated, ſmall fibres of wood from the ſaſhes of windows, the poſts of eſpaliers, garden doors, &c. but never attempt growing or green timber. Theſe fibres, which, though very ſlender, are often a line, or a twelfth part of an inch long. After cutting a certain number of them, the animals collect them into minute bundles, tranſport them to their neſt, and, by means of a glutinous ſubſtance furniſhed from their own bodies, form them into a moiſt and ductile paſte. Of this ſubſtance, or *papier maché*, they conſtruct the external cover, the partitions of the neſt, the hexagonal cells, and the ſolid columns which ſupport the ſeveral layers or ſtories of combs.

The conſtructing of the neſt occupies a comparatively ſmall number of labourers. The others are differently employed. Here it is neceſſary to remark, that the republics of waſps, like thoſe of the honey-bees, conſiſt of three kinds of flies, males, females, and neuters. Like the bees, alſo, the number of neuters far ſurpaſſes thoſe of both males and females. The greateſt quantity of labour is devolved upon the neuters; but they are not, like the neuter bees, the only workers; for there is no part of their different operations which the females, at certain times, do not execute. Neither do the males, though their induſtry is not comparable to that of the neuters, remain entirely idle. They often occupy themſelves in the interior part of the neſt. The greateſt part of the labour, however, is performed by the neuters. They build the neſt, feed the males, the females, and even the young. But, while the neuters are employed in theſe different operations, the others are abroad in hunting parties. Some attack with intrepidity live inſects, which they ſometimes carry entire to the neſt; but they generally tranſport the abdomen or belly only. Others pillage butchers ſtalls, from which they often arrive with a piece of meat larger than the half of their own bodies. Others reſort to gardens, and ſuck the juices of fruits. When they return to the neſt, they diſtribute a part of their plunder to the females, to the males, and even to ſuch neuters as have been uſefully occupied at home. As ſoon as a neuter enters the neſt, it is ſurrounded by ſeveral waſps, to each of whom it freely gives a portion of the food it has brought. Thoſe who have not been hunting for prey, but have been ſucking the juices of fruits, though they ſeem to return empty, fail not to regale their companions; for, after their arrival, they ſtation themſelves upon the upper part of the neſt, and diſcharge from their mouths two or three drops of a clear liquid, which are immediately ſwallowed by the domeſtics.

The neuter waſps, though the moſt laborious, are the ſmalleſt; but they are extremely active and vivacious. The females are much larger, heavier, and ſlower in their movements. The males are of an intermediate ſize between that of the females and neuters. From theſe differences in ſize, it is eaſy to diſtinguiſh the different kinds of thoſe waſps which build their neſts below the ground. In the hive of the honey-bee, the number of females is always extremely ſmall; but, in a waſp's neſt, there are often more than three hundred females. During the months of June, July, and Auguſt, they remain conſtantly in the neſt, and are never ſeen abroad except in the beginning of ſpring, and in the months of September and October. During the ſummer, they are totally occupied in laying their eggs and feeding their young. In this laſt operation, they are aſſiſted by the other waſps; for the females alone, though numerous, would be inſufficient for the laborious taſk. A waſp's neſt, when completed, ſometimes conſiſts of ſixteen thouſand cells, each of which contains an egg, a worm, or a nymph. The eggs are white, tranſparent, of an oblong figure, and differ in ſize, according to the kind of waſps which are to proceed from them. Some of them are no larger than the head of a ſmall pin. They are ſo firmly glued to the bottoms of the cells, that it is with difficulty they can be detached without breaking. Eight days after the eggs are depoſited in the cells, the worms are hatched, and are conſiderably larger than the eggs which gave birth to them. Theſe worms demand the principal cares of the waſps who continue always in the neſt. They feed them, as birds feed their young, by giving them, from time to time, a mouthful of food. It is aſtoniſhing to ſee with what induſtry and rapidity a female runs along the cells of a comb, and diſtributes to each worm a portion of nutriment. In proportion to the ages and conditions of the worms, they are fed with ſolid food, ſuch as the bellies of inſects, or with a liquid ſubſtance diſgorged by the mother. When a worm is ſo large as to occupy its whole cell, it is then ready to be metamorphoſed into a nymph. It then refuſes all nouriſhment, and ceaſes to have any connection with the waſps in the neſt. It ſhuts up the mouth of its cell with a fine ſilken cover, in the ſame manner as the ſilk-worm and other caterpillars ſpin their cods. This operation is completed in three or four hours, and the animal remains in the nymph ſtate nine or ten days, when, with its teeth, it deſtroys the external cover of the cell, and comes forth in the form of a winged inſect, which is either male, female, or neuter, according to the nature of the egg from which it was hatched. In a ſhort time, the waſps newly transformed receive the food brought into the neſt by the foragers in the fields. What is ſtill more curious, in the courſe of the firſt day after their transformation, the young waſps have been obſerved going to the fields, bringing in proviſions, and diſtributing them to the worms in the cells. A cell is no ſooner abandoned by a young waſp, than it is cleaned, trimmed, and repaired by an old one, and rendered, in every reſpect, proper for the reception of another egg.

As formerly mentioned, waſps of different ſexes differ greatly in ſize. The animals know how to conſtruct cells proportioned to the dimenſions of the fly that is to proceed from the egg which the female depoſits in them. The neuters are ſix times ſmaller than the females, and their cells are built nearly in the ſame proportion. Cells are not only adapted for the reception of neuters, males, and females, but it is remarkable that the cells of the neuters are never intermixed with thoſe of the males or females. A comb is entirely occupied with ſmall cells fitted for the reception of neuter worms. But male and female cells are often found in the ſame comb. The males and females are of equal length, and, of courſe, require cells of an equal deepneſs. But the cells of the males are narrower than thoſe of the females, becauſe the bodies of the former are never ſo thick as thoſe of the latter.

This wonderful aſſemblage of combs, of the pillars which ſupport them, and of the external envelope, is an edifice which requires ſeveral months labour, and ſerves the animals one year only. This habitation, ſo populous in ſummer, is almoſt deſerted in winter, and abandoned entirely in ſpring; for, in this laſt ſeaſon, not a ſingle waſp is to be found in a neſt of the preceding year. It is worthy of remark, that the firſt combs of a neſt are always accommodated for the reception of the neuter or working waſps. The city, of which the foundation has juſt been laid, requires a number of workmen. The neuter or working waſps are accordingly firſt produced. A cell is no ſooner half completed than an egg of a neuter is depoſited in it by the female. Of fourteen or fifteen combs incloſed in a common cover, the four laſt only are deſtined for the reception of males and females. Hence it uniformly happens, that, before the males and females are capable of taking flight, every waſp's neſt is peopled with ſeveral thouſand neuters or workers. But the neuters, who are firſt produced, are likewiſe the firſt that periſh; for not one of them ſurvives the termination even of a mild winter. It was remarked by the ancient naturaliſts, that ſome waſps lived one year only, and others two. To the former Ariſtotle gives the appellation of *operarii*, which are our workers or neuters, and to the latter *matrices*, which are our females.

The female waſps are ſtronger, and ſupport the rigours of winter better than the males or neuters. Before the end of winter, however, ſeveral hundred females die, and not above ten or a dozen in each neſt ſurvive that ſeaſon. Theſe few females are deſtined for the continuation of the ſpecies. Each of them becomes the founder of a new republic. When a queen-bee departs from a hive in order to eſtabliſh a new one, ſhe is always accompanied with ſeveral thouſand induſtrious labourers, ready to perform every neceſſary operation. But the female waſp has not the aid of a ſingle labourer; for all the neuters are dead before the beginning of the ſpring. The female alone lays the foundation of a new republic. She either finds or digs a hole under the earth, builds cells for the reception of her eggs, and feeds the worms which proceed from them. Whenever any of theſe neuter worms are transformed into flies, they immediately aſſiſt their parent in augmenting the number of cells and combs, and in feeding the young worms, which are daily hatching from the eggs. In a word, this female waſp, which in ſpring was perfectly ſolitary, without any proper habitation, and had every operation to perform, has, in autumn, ſeveral thouſands of her offspring at her devotion, and is furniſhed with a magnificent palace, or rather city, to protect her from the injuries of the weather and from external enemies.

With regard to the male waſps, it is uncertain whether any of them ſurvive the winter. But, though not ſo indolent as the males of the honey-bee, they can be of little aſſiſtance to the female; for they never engage in any work of importance, ſuch as conſtructing cells, or fortifying the external cover of the neſt. They are never brought forth till towards the end of Auguſt; and their ſole occupation ſeems to be that of keeping the neſt clean: They carry out every kind of filth, and the carcaſſes of ſuch of their companions as happen to die. In performing this operation, two of them often join, and, as mentioned in another place, when the load is too heavy, they cut off the head, and tranſport the dead animal at two times.

In the beginning of ſpring, when the female waſp has built her ſubterraneous habitation, which is ſoon to be peopled with thouſands of flies, ſhe has no occaſion for the males; becauſe, in the month of September or October, ſhe had been previouſly impregnated. The males and females are produced at the ſame time, and they are nearly equal in number. Like the male honey-bees, the male waſps are deſtitute of ſtings, but the females and neuters have ſtings, the poiſonous liquor of which, when introduced into any part of the human body, excites inflammation, and creates a conſiderable degree of pain.

The habitations and the oeconomy of the common *ant* are exceedingly curious. But, as they are ſo well known, and ſo obvious to inſpection and examination, we ſhall not detain the reader with a deſcription of them. To ſupply this defect, we ſhall give ſome account of the truly wonderful operations of the *termites*, which are generally called *white-ants* [*], though they belong to a different genus of inſects. Theſe animals infeſt Guinea, and all the tropical regions, where, for their depredations of property, they are greatly dreaded by the inhabitants; from which circumſtance they have received the name of *Fatalis* or *Deſtructor*.

The following abridged account of the *termites*, and of the wonderful habitations they build, is ſelected from an excellent deſcription of them in a Letter from Mr Henry Smeathman, of Clement's Inn, to Sir Joſeph Banks, which was publiſhed in the Philoſophical Tranſactions [†]. Though the neſts, or rather hills, conſtructed by the termites, are mentioned by many travellers, their deſcriptions and obſervations are by no means ſo accurate as thoſe of the ingenious Mr Smeathman. Of theſe inſects there are ſeveral ſpecies; but they all reſemble each other in form, and in their manner of living. They differ, however, as much as birds, in the ſtile of their architecture, and in the ſelection of the materials of which their neſts are compoſed. Some build on the ſurface, or partly above and partly below the ground, and others on the trunks or branches of lofty trees.

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[*] In the windward parts of Africa, they are denominated *bugga, buggs*; in the Weſt Indies, *wood-lice, wood-ants*, or *white-ants*. They are likewiſe called *piercers, eaters*, or *cutters*, becauſe they cut almoſt every thing in pieces.

[†] Vol. 71. part 1. page 139.

Before deſcribing the neſts or hills, it is neceſſary to give ſome idea of the animals themſelves, and of their general oeconomy and manners. We ſhall confine ourſelves to that ſpecies called *termites bellicoſi*, or *fighters*, becauſe they are largeſt, and beſt known on the coaſt of Africa.

The republic of the *termines bellicoſi*, like the other ſpecies of this genus, conſiſts of three ranks, or orders of inſects: 1. The working inſects, which Mr Smeathman diſtinguiſhes by the name of *labourers*; 2. The fighters, or *ſoldiers*, which perform no kind of labour; and, 3. The winged, or *perfect inſects*, which are male and female, and capable of multiplying the ſpecies. Theſe laſt Mr Smeathman calls the *nobility* or *gentry*; becauſe they neither labour nor fight. The nobility alone are capable of being raiſed to the rank of kings and queens. A few weeks after their elevation to this ſtate, they emigrate, in order to eſtabliſh new empires.

In a neſt or hill, the labourers, or working inſects, are always moſt numerous: There are at leaſt one hundred labourers to one of the fighting inſects or ſoldiers. When in this ſtate, they are about a fourth of an inch in length, which is rather ſmaller than ſome of our ants. From their figure, and fondneſs for wood, they are very generally known by the name of *wood-lice*.

The ſecond order, or ſoldiers, differ in figure from that of the labourers. The former have been ſuppoſed to be neuters, and the latter males. But, in fact, they are the ſame inſects. They have only undergone a change of form, and made a nearer approach to the perfect ſtate. They are now much larger, being half an inch in length, and equal in ſize to fifteen of the labourers. The form of the head is likewiſe greatly changed. In the labourer ſtate, the mouth is evidently formed for gnawing or holding bodies: But, in the ſoldier ſtate, the jaws being ſhaped like two ſharp awls a little jagged, are deſtined ſolely for piercing or wounding. For theſe purpoſes they are very well calculated; for they are as hard as a crab's claw, and placed in a ſtrong horny head, which is of a nut-brown colour, and larger than the whole body.

The figure of the third order, or that of the inſect in its perfect ſtate, is ſtill more changed. The head, the thorax, and the abdomen, differ almoſt entirely from the ſame parts in the labourers and ſoldiers. Beſide, the animals are now furniſhed with four large, browniſh, tranſparent wings, by which they are enabled, at the proper ſeaſon, to emigrate and to eſtabliſh new ſettlements. In the winged or perfect ſtate, they have likewiſe acquired the organs of generation, and are greatly altered in their ſize as well as in their figure. Their bodies now meaſure between ſix and ſeven tenths of an inch, their wings, from tip to tip, above two inches and a half, and their bulk is equal to that of thirty labourers, or two ſoldiers. Inſtead of active, induſtrious, and rapacious little animals, when they arrive at their perfect ſtate, they become innocent, helpleſs, and daſtardly. Their numbers are great; but their enemies are ſtill more numerous. They are devoured by birds, by every ſpecies of ants, by carnivorous reptiles, and even by the inhabitants of many parts of Africa. This laſt fact is atteſted by Piſo, Margraave, De Laet, Konig, Moor, Sparman, and by many other travellers, as well as by Smeathman. After ſuch devaſtation, it is ſurpriſing that a ſingle pair ſhould eſcape ſo many dangers. ‘Some, however,’ ſays Mr Smeathman, ‘are ſo fortunate; and being found by ſome of the ‘labouring inſects, that are continually running about the ſurface of

‘ the ground under their covered galleries, are *elected Kings* and ‘ *Queens* of new ſtates; all thoſe who are not ſo elected and pre‘ ſerved certainly periſh. The manner in which theſe labourers ‘ protect the happy pair from their innumerable enemies, not only ‘ on the day of the maſſacre of almoſt all their race, but for a long ‘ time after, will, I hope, juſtify me in the uſe of the term *election.* ‘ The little induſtrious creatures immediately incloſe them in a ſmall ‘ chamber of clay ſuitable to their ſize, into which, at firſt, they ‘ leave but one ſmall entrance, large enough for themſelves and the ‘ ſoldiers to go in and out, but much too little for either of the roy‘ al pair to make uſe of; and, when neceſſity obliges them to make ‘ more entrances, they are never larger; ſo that, of courſe, the *vo‘ luntary ſubjects* charge themſelves with the taſk of providing for ‘ the offspring of their ſovereigns, as well as to work and to fight ‘ for them, until they have raiſed a progeny capable at leaſt of di‘ viding the taſk with them.

‘ It is not till this, probably, that they conſummate their mar‘ riage, as I never ſaw a pair of them joined. The buſineſs of pro‘ pagation, however, ſoon commences; and the labourers having ‘ conſtructed a ſmall wooden nurſery, carry the eggs and lodge ‘ them there as faſt as they can obtain them from the *queen.*

‘ About this time a moſt extraordinary change begins to take ‘ place in the *queen*, to which I know nothing ſimilar, except in the ‘ *pulex penetrans* of Linnaeus, the *jigger* of the Weſt Indies, and in ‘ the different ſpecies of *coccus*, *cochineal.* The abdomen of this fe‘ male begins gradually to extend and enlarge to ſuch an enormous ‘ ſize, that an *old queen* will have it increaſed ſo as to be *fifteen hun‘ dred* or *two thouſand times* the bulk of the reſt of her body, and ‘ *twenty* or *thirty thouſand times* the bulk of a labourer, as I have ‘ found by carefully weighing and computing the different ſtates.

'The ſkin between the ſegments of the abdomen extends in every 'direction; and at laſt the ſegments are removed to half an inch 'diſtance from each other, though, at firſt, the length of the whole 'abdomen is not half an inch. I conjecture the animal is upwards 'of two years old when the abdomen is increaſed to three inches in 'length: I have ſometimes found them of near twice that ſize. The 'abdomen is now of an irregular oblong ſhape, being contracted by 'the muſcles of every ſegment, and is become one vaſt matrix full 'of eggs, which make long circumvolutions through an innumerable 'quantity of very minute veſſels that circulate round the inſide in a 'ſerpentine manner, which would exerciſe the ingenuity of a ſkill'ful anatomiſt to diſſect and develope. This ſingular matrix is not 'more remarkable for its amazing extenſion and ſize than for its 'periſtaltic motion, which reſembles the undulating of waves, and 'continues inceſſantly without any apparent effort of the animal; 'ſo that one part or other, alternately, is riſing and ſinking in per'petual ſucceſſion, and the matrix ſeems never at reſt, but is always 'protruding eggs to the amount (as I have frequently counted in 'old queens) of ſixty in a minute, or eighty thouſand and upward 'in one day of twenty-four hours.

'Theſe eggs are inſtantly taken from her body by her attendants, '(of whom there always are, in the royal chamber and the galleries 'adjacent, a ſufficient number in waiting), and carried to the nurſe'ries, which, in a great neſt, may ſome of them be four or five feet 'diſtant in a ſtraight line, and, conſequently, much farther by their 'winding galleries. Here, after they are hatched, the young are 'attended and provided with every thing neceſſary until they are 'able to ſhift for themſelves, and take their ſhare of the labours of 'the community.'

We ſhall now endeavour to give ſome idea of the almoſt incredible architecture and oeconomy of theſe wonderful inſects.

The neſts of the *termites bellicoſi*, or wood-lice, are called *hills* by the natives of Africa, New Holland, and other hot climates. This appellation is highly proper; for they are often elevated ten or twelve feet above the ſurface of the earth, and are nearly of a conical figure. Theſe hills, inſtead of being rare phenomena, are ſo frequent in many places near Senegal, that, as deſcribed with great propriety by Monſ. Adanſon, their number, magnitude, and cloſeneſs of ſituation, make them appear like villages of the Negroes. 'But, of all the extraordinary things I obſerved,' ſays Monſ. Adanſon, 'nothing ſtruck me more than certain eminences, which, by 'their height and regularity, made me take them, at a diſtance, for 'an aſſemblage of Negroe huts, or a conſiderable village, and yet 'they were only the neſts of certain inſects. Theſe neſts are round 'pyramids, from eight to ten feet high, upon nearly the ſame baſe, 'with a ſmooth ſurface of rich clay, exceſſively hard and well built *.' Jobſon, in his hiſtory of Gambia, tells us, that 'the ant-hills are 'remarkable caſt up in thoſe parts by piſmires, ſome of them twenty foot in height, of compaſſe to contayne a dozen of men, with 'the heat of the ſun baked into that hardneſſe, that we uſed to hide 'ourſelves in the ragged toppes of them, when we took up ſtands 'to ſhoot at deere or wild beaſts †.' Mr Boſman remarks, in his deſcription of Guinea, that 'the ants make neſts of the earth about 'twice the height of a man ‡.'

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* Adanſon's Voyage to Senegal, 8vo, pag. 153.—337. Voyage de Senegal, 4to, pag. 83.—99.

† Purchas's Pilgrams, vol. 2. pag. 1570.

‡ Page 276.—493.

Each of theſe hills is compoſed of an exterior and an interior part. The exterior cover is a large clay-ſhell, which is ſhaped like a dome. Its ſtrength and magnitude are ſufficient to incloſe and protect the interior building from the injuries of the weather, and to defend its numerous inhabitants from the attacks of natural or accidental enemies. The external dome or cover is, therefore, always much ſtronger than the internal building, which is the habitation of the inſects, and is divided with wonderful artifice and regularity into a vaſt number of apartments for the reſidence and accommodation of the king and queen, for the nurſing of their progeny, and for magazines, which are always well ſtored with proviſions.

Theſe hills make their firſt appearance in the form of conical turrets about a foot high. In a ſhort time, the inſects erect, at a little diſtance, other turrets, and go on increaſing their number and widening their baſes, till their underworks are covered with theſe turrets, which the animals always raiſe higheſt in the middle of the hill, and, by filling up the intervals between each turret, collect them, at laſt, into one great dome.

'The *royal chamber*,' Mr Smeathman remarks, 'which is occu-'pied by the king and queen, appears to be, in the opinion of this 'little people, of the moſt conſequence, and is always ſituated as 'near the centre of the interior building as poſſible, and generally 'about the height of the common ſurface of the ground. It is al-'ways nearly in the ſhape of half an egg, or an obtuſe oval, within, 'and may be ſuppoſed to repreſent a long oven. In the infant ſtate 'of the colony, it is not above an inch, or thereabout, in length; 'but in time will be increaſed to ſix or eight inches, or more, in the 'clear, being always in proportion to the ſize of the queen, who, 'increaſing in bulk as in age, at length requires a chamber of ſuch 'dimenſions.'

The entrances into the royal chamber will not admit any animal larger than the ſoldiers or labourers. Hence the *king* and the *queen*, which laſt, when full grown, is a thouſand times the weight of a king, can never poſſibly go out. The royal chamber is ſurrounded by an innumerable quantity of others, which are of different ſizes, figures, and dimenſions; but all of them are arched either in a circular or an elliptical form. Theſe chambers either open into each other, or have communicating paſſages, which being always clear, are evidently intended for the conveniency of the ſoldiers and attendants, of whom, as will ſoon appear, great numbers are neceſſary. Theſe apartments are joined by the magazines and nurſeries. The magazines are chambers of clay, and are at all times well ſtored with proviſions, which, to the naked eye, ſeem to conſiſt of the raſpings of wood and plants which the termites deſtroy; but, when examined by the microſcope, they are found to conſiſt chiefly of the gums or inſpiſſated juices of plants, thrown together in ſmall irregular maſſes. Of theſe maſſes, ſome are finer than others, and reſemble the ſugar about preſerved fruits; others reſemble the tears of gum, one being quite tranſparent, another like amber, a third brown, and a fourth perfectly opaque.

The magazines are always intermixed with the nurſeries, which laſt are buildings totally different from the reſt of the apartments. They are compoſed entirely of wooden materials, which ſeem to be cemented with gums. Mr Smeathman very properly gives them the appellation of *nurſeries;* becauſe they are invariably occupied by the eggs, and the young ones, which firſt appear in the ſhape of labourers; but they are as white as ſnow. Theſe buildings are exceedingly compact, and are divided into a number of ſmall irregular-ſhaped chambers, not one of which is half an inch wide. They are placed all round, and as near as poſſible to the royal apartments.

When a neſt or hillock is in the infant ſtate, the nurſeries are cloſe to the royal apartment. But as, in proceſs of time, the body of the queen enlarges, it becomes neceſſary, for her accommodation, to augment the dimenſions of her chamber. She then, likewiſe, lays a greater number of eggs, and requires more attendants; of courſe, it is neceſſary that both the number and dimenſions of the adjacent apartments ſhould be augmented. For this purpoſe, the ſmall firſt built nurſeries are taken to pieces, rebuilt a little farther off, made a ſize larger, and their number, at the ſame time, is increaſed. Thus the animals are continually employed in pulling down, repairing, or rebuilding their apartments; and theſe operations they perform with wonderful ſagacity, regularity, and foreſight.

One remarkable circumſtance regarding the nurſeries muſt not be omitted. They are always ſlightly overgrown with a kind of *mould*, and plentifully ſprinkled with white globules about the ſize of a ſmall pin's head. Theſe globules, Mr Smeathman at firſt conjectured to be the eggs; but, when examined by the microſcope, they evidently appeared to be a ſpecies of muſhroom, in ſhape reſembling our eatable muſhroom when young. When entire, they are white like ſnow a little melted and frozen again; and, when bruiſed, they ſeem to be compoſed of an infinite number of pellucid particles, approaching to oval forms, and are with difficulty ſeparated from each other. The mouldineſs ſeems likewiſe to conſiſt of the ſame kind of ſubſtance *.

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* Mr Konig, who examined the termites neſts in the Eaſt Indies, conjectures, that theſe muſhrooms are the food of the young inſects This ſuppoſition implies, that the old ones have a method of providing for and promoting the growth of the muſhroom; 'a circumſtance,' Mr Smeathman remarks, 'which, however ſtrange to 'thoſe unacquainted with the ſagacity of thoſe inſects, I will venture to ſay, from 'many other extraordinary facts I have ſeen of them, is not very improbable.'

The nurſeries are encloſed in chambers of clay, like thoſe which contain the proviſions; but they are much larger. In the early ſtate of the neſt, they are not bigger than an hazel nut; but, in great hills, they are often as large as a child's head of a year old.

The royal chamber is ſituated nearly on a level with the ſurface of the ground, at an equal diſtance from all the ſides of the building, and directly under the apex of the hill. On all ſides, both above and below, it is ſurrounded by what are called the *royal apartments*, which contain only labourers and ſoldiers, who can be intended for no other purpoſe than to continue in the neſt either to guard or ſerve their common *father* and *mother*, on whoſe ſafety the happineſs, and, in the eſtimation of the Negroes, the exiſtence of the whole community depends. Theſe apartments compoſe an intricate labyrinth, which extends a foot or more in diameter from the *royal chamber* on every ſide. Here the nurſeries and magazines of proviſions begin; and, being ſeparated by ſmall empty chambers and galleries, which ſurround them, and communicate with each other, are continued on all ſides to the outward ſhell, and reach up within it two thirds or three-fourths of its height, leaving an open area in the middle under the dome, which reſembles the nave of an old cathedral. This area is ſurrounded by large Gothic arches, which are ſometimes two or three feet high next the front of the area, but diminiſh rapidly as they recede, like the arches of aiſles in perſpectives, and are ſoon loſt among the innumerable chambers and nurſeries behind them. All theſe chambers and paſſages are arched, and contribute mutually to ſupport one another. The interior building, or aſſemblage of nurſeries, chambers, and paſſages, has a flattiſh roof without any perforation. By this contrivance, if, by accident, water ſhould penetrate the external dome, the apartments below are preſerved from injury. The area has alſo a flattiſh floor, which is ſituated above the royal chamber. It is likewiſe water-proof, and ſo conſtructed, that, if water gets admittance, it runs off by ſubterraneous paſſages, which are of an aſtoniſhing magnitude. 'I meaſured one of them,' ſays Mr Smeathman, 'which was perfectly cylindrical, and thirteen inches in diameter.' Theſe ſubterraneous paſſages are thickly lined with the ſame kind of clay of which the hill is compoſed, aſcend the internal part of the external ſhell in a ſpiral form, and, winding round the whole building up to the top, interſect and communicate with each other at different heights. From every part of theſe large galleries a number of pipes, or ſmaller galleries, leading to different apartments of the building, proceed. There are likewiſe a great many which lead downward, by ſloping deſcents, three and four feet perpendicular under ground, among the gravel, from which the labouring termites ſelect the finer parts, which, after being worked up in their mouths to the conſiſtence of mortar, become that ſolid clay or ſtone of which their hills, and every apartment of their buildings, except the nurſeries, are compoſed. Other galleries aſcend and lead out horizontally on every ſide, and are carried under ground, but near the ſurface, to great diſtances. Suppoſe the whole neſts within a hundred yards of a houſe were completely deſtroyed, the inhabitants of thoſe at a greater diſtance will carry on their ſubterraneous galleries, and invade the goods and merchandizes contained in it by ſap and mine, unleſs great attention and circumſpection are employed by the proprietor.

Mr Smeathman concludes his deſcription of the habitations of the *termites bellicoſi*, with much modeſty, in the following words: 'Thus I have deſcribed, as briefly as the ſubject would admit, and I 'truſt without exaggeration, thoſe wonderful buildings, whoſe ſize, 'and external form, have often been mentioned by travellers, but 'whoſe interior, and moſt curious parts are ſo little known, that I 'may venture to conſider my account of them as new, which is the 'only merit it has; for they are conſtructed upon ſo different a plan

‘ from any thing elſe upon the earth, and ſo complicated, that I can‘ not find words equal to the taſk.’

When a breach is made in one of the hills by an ax, or other inſtrument, the firſt object that attracts attention is the behaviour of the ſoldiers, or fighting inſects. Immediately after the blow is given, a ſoldier comes out, walks about the breach, and ſeems to examine the nature of the enemy, or the cauſe of the attack. He then goes in to the hill, gives the alarm, and, in a ſhort time, large bodies ruſh out as faſt as the breach will permit. It is not eaſy to deſcribe the fury theſe fighting inſects diſcover. In their eagerneſs to repel the enemy, they frequently tumble down the ſides of the hill, but recover themſelves very quickly, and bite every thing they encounter. This biting, joined to the ſtriking of their forceps upon the building, makes a crackling or vibrating noiſe, which is ſomewhat ſhriller and quicker than the ticking of a watch, and may be heard at the diſtance of three or four feet. While the attack proceeds, they are in the moſt violent buſtle and agitation. If they get hold of any part of a man’s body, they inſtantly make a wound, which diſcharges as much blood as is equal to their own weight. When they attack the leg, the ſtain of blood upon the ſtocking extends more than an inch in width. They make their hooked jaws meet at the firſt ſtroke, and never quit their hold, but ſuffer themſelves to be pulled away leg by leg, and piece after piece, without the ſmalleſt attempt to eſcape. On the other hand, if a perſon keeps out of their reach, and gives them no farther diſturbance, in leſs than half an hour they retire into the neſt, as if they ſuppoſed the wonderful monſter that damaged their caſtle had fled. Before the whole ſoldiers have got in, the labouring inſects are all in motion, and haſten toward the breach, each of them having a quantity of tempered mortar in his mouth. This mortar they ſtick upon the breach as faſt as they arrive, and perform the operation with ſo much deſpatch and facility,

lity, that, notwithſtanding the immenſity of their numbers, they never ſtop or embarraſs one another. During this ſcene of apparent hurry and confuſion, the ſpectator is agreeably ſurpriſed when he perceives a regular wall gradually ariſing and filling up the chaſm. While the labourers are thus employed, almoſt all the ſoldiers remain within, except here and there one, who ſaunters about among ſix hundred or a thouſand labourers, but never touches the mortar. One ſoldier, however, always takes his ſtation cloſe to the wall that the labourers are building. This ſoldier turns himſelf leiſurely on all ſides, and, at intervals of a minute or two, raiſes his head, beats upon the building with his forceps, and makes the vibrating noiſe formerly mentioned. A loud hiſs inſtantly iſſues from the inſide of the dome and all the ſubterraneous caverns and paſſages. That this hiſs proceeds from the labourers is apparent; for, at every ſignal of this kind, they work with redoubled quickneſs and alacrity. A renewal of the attack, however, inſtantly changes the ſcene. ‘ On ‘ the firſt ſtroke,’ Mr Smeathman remarks, ‘ the labourers run into ‘ the many pipes and galleries with which the building is perforated, ‘ which they do ſo quickly, that they ſeem to vaniſh ; for in a few ‘ ſeconds all are gone, and the ſoldiers ruſh out as numerous and as ‘ vindictive as before. On finding no enemy, they return again leiſurely into the hill, and, very ſoon after, the labourers appear load- ‘ ed as at firſt, as active, and as ſedulous, with ſoldiers here and ‘ there among them, who act juſt in the ſame manner, one or other ‘ of them giving the ſignal to haſten the buſineſs. Thus the plea- ‘ ſure of ſeeing them come out to fight or to work, alternately, may ‘ be obtained as often as curioſity excites, or time permits; and it ‘ will certainly be found, that the one order never attempts to fight, ‘ or the other to work, let the emergency be ever ſo great.’

It is exceedingly difficult to explore the interior parts of a neſt or hill. The apartments which ſurround the royal chamber and the nurſeries, and indeed the whole fabrick, have ſuch a dependence on each other, that the breaking of one arch generally pulls down two or three. There is another great obſtacle to our reſearches, namely, the obſtinacy of the ſoldiers, who, ſays our author, 'fight to the 'very laſt, diſputing every inch of ground ſo well as often to 'drive away the Negroes who are without ſhoes, and make white 'people bleed plentifully through their ſtockings. Neither can we 'let a building ſtand ſo as to get a view of the interior parts with- 'out interruption; for, while the ſoldiers are defending the out- 'works, the labourers keep barricading all the way againſt us, ſtop- 'ping up the different galleries and paſſages which lead to the vari- 'ous apartments, particularly the royal chamber, all the entrances to 'which they fill up ſo artfully as not to let it be diſtinguiſhable 'while it remains moiſt; and, externally, it has no other appearance 'than that of a ſhapeleſs lump of clay. It is, however, eaſily found 'from its ſituation with reſpect to the other parts of the building, 'and by the crowds of labourers and ſoldiers which ſurround it, who 'ſhow their loyalty and fidelity by dying under its walls. The roy- 'al chamber, in a large neſt, is capacious enough to hold many hun- 'dreds of the attendants, beſides the royal pair; and you always find 'it as full of them as it can hold. Theſe faithful ſubjects never 'abandon their charge even in the laſt diſtreſs; for, whenever I took 'out the royal chamber, and, as I often did, preſerved it for ſome 'time in a large glaſs bowl, all the attendants continued running in 'one direction round the king and queen with the utmoſt ſolicitude, 'ſome of them ſtopping at the head of the latter, as if to give her 'ſomething. When they came to the extremity of the abdomen, 'they took the eggs from her, and carried them away, and piled 'them carefully together in ſome part of the chamber, or in the 'bowl under, or behind any pieces of broken clay which lay moſt 'convenient for the purpoſe.'

In this chapter, I have given a ſuccinct view of the ſagacity, dexterity, and architectonic powers, exhibited in the conſtruction of habitations by the different claſſes of animals. But I am not without apprehenſions, that, in my endeavours to avoid prolixity, I may have, in ſome inſtances, degenerated into obſcurity. Enough, however, I hope, has been ſaid, either for the purpoſes of admiration or of reaſoning; and, therefore, I ſhall not anticipate the reflections of my readers, but proceed to the next ſubject.

CHAPTER XIV.

Of the Hoſtilities of Animals.

IN contemplating the ſyſtem of animation exhibited in this planet, the only one of which we have any extenſive knowledge, the mind is ſtruck, and even confounded, with the general ſcene of havock and devaſtation which is perpetually, and every where, preſented to our view. There is not, perhaps, a ſingle ſpecies of animated beings, whoſe exiſtence depends not, more or leſs, upon the death and deſtruction of others. Every animal, when not prematurely deprived of life by thoſe who are hoſtile to it, or by accident, enjoys a temporary exiſtence, the duration of which is longer or ſhorter according to its nature, and the rank it holds in the creation; and this exiſtence univerſally terminates in death and diſſolution. This is an eſtabliſhed law of Nature, to which every animal is obliged to ſubmit. But this neceſſary and univerſal deprivation of individual life, though great, is nothing when compared to the havock occaſioned by another law, which impels animals to kill and devour different ſpecies, and ſometimes their own. In the ſyſtem of Nature, death and diſſolution ſeem to be indiſpenſible for the ſupport and continuation of animal life.

But, though almoſt every animal, in ſome meaſure, depends for its exiſtence on the deſtruction of others, there are ſome ſpecies in all the different tribes or claſſes, which are diſtinguiſhed by the appellation of *carnivorous* or *rapacious*, becauſe they live chiefly, or entirely, on animal food. In the proſecution of this ſubject, therefore, we ſhall, in the *firſt* place, mention ſome examples of animal hoſtility and rapacity; and, in the *next* place, endeavour to point out ſuch advantages as reſult from this apparently cruel inſtitution of Nature. On the laſt branch of the ſubject, however, the reader muſt not expect to have every difficulty removed, and every queſtion ſolved. Like all the other parts of the oeconomy of Nature, the neceſſity, or even the ſeeming cruelty and injuſtice, of allowing animals to prey upon one another, is a myſtery which we can never be enabled completely to unravel. But we are not entirely without hopes of ſhowing ſeveral important utilities which reſult from this almoſt univerſal ſcene of animal devaſtation.

Of all rapacious animals, *Man* is the moſt univerſal deſtroyer. The deſtruction of carnivorous quadrupeds, birds, and inſects, is, in general, limited to particular kinds. But the rapacity of man has hardly any limitation. His empire over the other animals which inhabit this globe is almoſt univerſal. He accordingly employs his power, and ſubdues or devours every ſpecies. Of ſome of the quadruped tribes, as the horſe, the dog, the cat, he makes domeſtic ſlaves; and, though in this country, none of theſe ſpecies is uſed for food, he either obliges them to labour for him, or keeps them as ſources of pleaſure and amuſement. From other quadrupeds, as the ox, the ſheep, the goat, and the deer kind, he derives innumerable advantages. The ox-kind, in particular, after receiving the emoluments of their labour and fertility, he rewards with death, and then feeds upon their carcaſſes. Many other ſpecies, though not commonly uſed as food, are daily maſſacred in millions for the purpoſes of commerce, luxury, and caprice. Myriads of quadrupeds are annually deſtroyed for the ſake of their furs, their hides, their tuſks, their odoriferous ſecretions, &c.

Over the feathered tribes the dominion of man is not leſs extenſive. There is not a ſingle ſpecies in the numerous and diverſified claſs of birds, which he either does not, or may not, employ for the nouriſhment of his body. By his ſagacity and addreſs he has been enabled to domeſticate many of the more prolific and delicious ſpecies, as turkies, geeſe, and the various kinds of poultry. Theſe he multiplies without end, and devours at pleaſure.

Neither do the inhabitants of the waters eſcape the rapacity of man. Rivers, lakes, and even the ocean itſelf, feel the power of his empire, and are forced to ſupply him with proviſions. Neither air nor water can defend againſt the ingenuity, the art, and the deſtructive induſtry of the human ſpecies. Man may be ſaid even to have domeſticated ſome fiſhes. In artificial ponds, he feeds and rears carp, tench, perch, trout, and other ſpecies, and with them occaſionally furniſhes his table.

It might have been expected, that inſects and reptiles, ſome of which have a moſt diſguſting aſpect, would not have excited the human appetite. But we learn from experience, that, in every region of the earth, many inſects which inhabit both the earth and the waters, are eſteemed as delicate articles of luxury. Even the viper, though its venom be deleterious, eſcapes not the all-devouring jaws of man.

Thus man holds, and too often exerciſes, a tyrannical dominion over almoſt the whole brute creation, not becauſe he is the ſtrongeſt of all animals, but becauſe his intellect, though of a ſimilar nature, is vaſtly ſuperior to that of the moſt ſagacious of the leſs favoured tribes. He reigns over the other animals, becauſe, like them, he is not only endowed with ſentiment, but becauſe the powers of his mind are more extenſive. He overcomes force by ingenuity, and ſwiftneſs by art and perſevering induſtry. But the empire of man over the brute creation is not abſolute. Some ſpecies elude his power by the rapidity of their flight, by the ſwiftneſs of their courſe, by the obſcurity of their retreats, and by the element in which they live. Others eſcape him by the minuteneſs of their bodies; and, inſtead of acknowledging their ſovereign, others boldly attack him with open hoſtility. He is alſo inſulted and injured by the ſtings of inſects, and by the poiſonous bites of ſerpents. In other reſpects, man's empire, though comparatively great, is very much limited. He has no influence on the univerſe, on the motions and affections of the heavenly bodies, or on the revolutions of the globe which he inhabits. Neither has he a general dominion over animals, vegetables, or minerals. His power reaches not ſpecies, but is confined to individuals. Every order of being moves on in its courſe, periſhes, or is renewed, by the irreſiſtible power of Nature. Even man himſelf, hurried along by the general torrent of time and of Nature, cannot prolong his exiſtence. He is obliged to ſubmit to the univerſal law; and, like all other organized beings, he is born, grows to maturity, and dies. Though man has been enabled to ſubdue the animal creation by the ſuperior powers of his mind, his empire, like all other empires, could not be firmly eſtabliſhed previous to the inſtitution of pretty numerous ſocieties. Almoſt the whole of his power is derived from ſociety. It matures his reaſon, gives exertion to his genius, and unites his forces. Before the formation of large ſocieties, man was perhaps the moſt helpleſs and the leaſt formidable of all animals. Naked, and deſtitute of arms, to him the earth was only an immenſe deſert peopled with ſtrong and rapacious monſters, by whom he was often devoured. Even long after this period, hiſtory informs us, that the firſt heroes were deſtroyers of wild beaſts. But, after the human ſpecies had multiplied, and ſpread over the earth, and when, by means of ſociety and the arts, man was enabled to conquer a conſiderable part of the globe, he forced the wild beaſts gradually to retire to the deſerts. He cleared the earth of thoſe gigantic animals who, perhaps, now no longer exiſt, but whoſe enormous bones are ſtill found in different regions, and are preſerved in the cabinets of the curious. He reduced the numbers of the voracious and noxious ſpecies. He oppoſed the powers and the dexterity of one animal to thoſe of another. Some he ſubdued by addreſs, and others by force. In this manner he, in proceſs of time, acquired to himſelf perfect ſecurity, and eſtabliſhed an empire that has no other limits than inacceſſible ſolitudes, burning ſands, frozen mountains, or obſcure caverns, which are occupied as retreats by a few ſpecies of ferocious animals.

Next to *man*, the carnivorous *quadrupeds* are the moſt numerous and the moſt deſtructive. Different parts of the earth are infeſted with lions, tigers, panthers, ounces, leopards, jaguars, couguars, lynxes, wild cats, dogs, jackals, wolves, foxes, hyaenas, civets, genets, polecats, martins, ferrets, ermines, gluttons, bats, &c. Though all theſe, and many other tribes of quadrupeds, live ſolely upon blood and carnage, yet ſome of them, as the tiger, the wolf, the hyaena, and many other inferior ſpecies, are much more rapacious and deſtructive than others. The lion, though ſurrounded with prey, kills no more than he is able to conſume. But the tiger is groſsly ferocious, and cruel without neceſſity. Though ſatiated with carnage, he perpetually thirſts for blood. His reſtleſs fury has no intervals, except when he is obliged to lie in ambuſh for prey at the ſides of lakes or rivers, to which other animals reſort for drink. He ſeizes and tears in pieces a freſh animal with equal rage as he exerted in devouring the firſt. He deſolates every country that he inhabits, and dreads neither the aſpect nor the arms of man. He ſacrifices whole flocks of domeſtic animals, and all the wild beaſts which come within the reach of his terrible claws. He attacks the young of the elephant and rhinoceros, and ſometimes even ventures to brave the lion. His predominant inſtinct is a perpetual rage, a blind and undiſtinguiſhing ferocity, which often impel him to devour his own young, and to tear their mother in pieces when ſhe attempts to defend them. He delights in blood, and gluts himſelf with it till he is intoxicated. He tears the body for no other purpoſe than to plunge his head into it, and to drink large draughts of blood, the ſources of which are generally exhauſted before his thirſt is appeaſed. The tiger is perhaps the only animal whoſe ferocity is unconquerable. Neither violence, reſtraint, nor bribery, have any effect in ſoftening his temper. With harſh or gentle treatment he is equally irritated. The mild and conciliating influence of ſociety makes no impreſſion on the obduracy and incorrigibleneſs of his diſpoſition. Time, inſtead of ſoftening the ferociouſneſs of his nature, only exaſperates his rage. He tears, with equal wrath, the hand which feeds him, as that which is raiſed to ſtrike him. He roars and grins at the ſight of every living being. Every animated object he regards as a freſh prey, which he devours before hand with the avidity of his eyes, menaces it with frightful groans, and often ſprings at it, without regarding his chains, which only reſtrain, but cannot calm his fury.

In temperate climates, the wolf ſeems to exceed all other animals in the ferocity and rapaciouſneſs of his diſpoſition. When preſſed with hunger, he braves every danger. He attacks all thoſe animals which are under the protection of man, eſpecially ſuch as he can carry off with eaſe, as lambs, kids, and the ſmaller kinds of dogs. When ſucceſsful in his expeditions, he returns often to the charge, till, after being chaced and wounded by men and dogs, he retires, during the day, to his den. In the night he again iſſues forth, traverſes the country, roams round the cottages, kills all the animals which have been left without, digs the earth under the doors, enters with a terrible ferocity, and puts every living creature to death, before he chooſes to depart, and carry off his prey. When theſe inroads happen to be fruitleſs, he returns to the woods, ſearches about with avidity, follows the track and the ſcent of wild beaſts, and purſues them till they fall a prey to his rapacity. In a word, when his hunger is extreme, he loſes all idea of fear, attacks women and children, and ſometimes men; at laſt he becomes perfectly furious by exceſſive exertions, and generally falls a ſacrifice to pure rage and diſtraction. When ſeveral wolves appear together, it is not an aſſociation of peace, but of war. It is attended with tumult and dreadful growlings, and indicates an attack upon ſome of the larger animals, as a ſtag, an ox, or a formidable maſtive. This depredatory expedition is no ſooner ended than they ſeparate, and every individual returns in ſilence to his ſolitude. Wolves are fond of human fleſh. They have been known to follow armies, to come in troops to the field of battle, where bodies are careleſsly interred, to tear them up, and to devour them with an inſatiable avidity: And, when once accuſtomed to human fleſh, theſe wolves ever after attack men, prefer the ſhepherd to the flock, devour women, and carry off children. Whole countries are ſometimes obliged to arm, in order to deſtroy the wolves. It is a fortunate circumſtance that theſe dangerous and deſtructive animals have been long totally extirpated from Great Britain and her iſlands.

Neither are the *feathered tribes* exempted from the general law of devaſtation. But the number of birds of prey, properly ſo called, is much leſs in proportion than that of carnivorous quadrupeds. Birds of prey are likewiſe weaker; and, of courſe, the deſtruction of animal life they occaſion is much more limited than the immenſe devaſtations daily committed by rapacious quadrupeds. But, as if tyranny never loſt ſight of its rights, great numbers of birds make prodigious depredations upon the inhabitants of the waters. A vaſt tribe of birds frequent the waters, and live ſolely upon fiſhes. In a certain ſenſe, every ſpecies of bird may be ſaid to be a bird of prey; for almoſt the whole of them devour flies, worms, and other inſects, either for food to themſelves or their young. Birds of prey, like carnivorous quadrupeds, are not ſo prolific as the milder and more inoffenſive kinds. Moſt of them lay only a ſmall number of eggs. The great eagle and the oſprey produce only two eggs in a ſeaſon. The pigeon, it may be ſaid, lays no more. But it ſhould be conſidered that the pigeon produces two eggs three, four, or five times, from ſpring to autumn. All birds of prey exhibit an obduracy and a ferociouſneſs of diſpoſition, while the other kinds are mild, chearful, and gentle, in their aſpect and manners. Moſt birds of prey expel their offspring from the neſt, and relinquiſh them to their fate, before they are ſufficiently able to provide for themſelves. This cruelty is the effect of perſonal want in the mother. When prey is ſcanty, which often happens, ſhe in a manner ſtarves herſelf to ſupport her young. But, when her hunger becomes exceſſive, ſhe forgets her parental affection, ſtrikes, expels, and ſometimes, in a paroxyſm of fury produced by want, kills her offspring. An averſion to ſociety is another effect of this natural and acquired obduracy of temper. Birds of prey, as well as carnivorous quadrupeds, never aſſociate. Like robbers, they lead a ſolitary and wandering life. Mutual attachment unites the male and the female; and, as they are both capable of providing for themſelves, and can give mutual aſſiſtance in making war againſt other animals, they never ſeparate, even after the ſeaſon of love. The ſame pair are uniformly found in the ſame place; but they never aſſemble in flocks, nor even aſſociate in families. The larger kinds, as the eagles, require a greater quantity of food, and, for that reaſon, never allow their own offſpring,

ſpring, after they have become rivals, to approach the places which the parents frequent. But all thoſe birds, and all thoſe quadrupeds, which are nouriſhed by the productions of the earth, live in families, are fond of ſociety, and aſſemble in numerous flocks, without quarrelling or diſturbing one another.

Both the earth and the air furniſh examples of rapacious animals. In theſe elements, however, the number of carnivorous animals is comparatively ſmall. But every inhabitant of the *waters* depends for its exiſtence upon rapine and deſtruction. The life of every *fiſh*, from the ſmalleſt to the greateſt, is one continued ſcene of hoſtility, violence, and evaſion. Their appetite for food is almoſt inſatiable. It impels them to encounter every danger. They are in continual motion; and the object of all their movements is to devour other fiſhes, or to avoid their own deſtruction. Their deſire for food is ſo keen and undiſtinguiſhing, that they greedily ſwallow every thing which has the appearance of animation. Thoſe that have ſmall mouths feed upon worms and the ſpawn of other fiſhes; and thoſe whoſe mouths are larger devour every animal, their own ſpecies not excepted, that can paſs through their gullet. To avoid deſtruction, the ſmaller fry retire to the ſhallows, where the larger kinds are unable to purſue them. But, in the watery element, no ſituation is abſolutely ſafe; for, even in the ſhallows, the oyſter, the ſcallop, and the muſcle, lie in ambuſh at the bottom, with their ſhells open, and, when a ſmall fiſh comes into contact with them, they inſtantly cloſe their ſhells upon him, and devour at leiſure their impriſoned prey. Neither is the hunting or purſuit of fiſhes confined to particular regions. Shoals of one ſpecies follow, with unwearied ardour, thoſe of another through vaſt tracts of the ocean. The cod purſues the whiting from the banks of Newfoundland to the ſouthern coſts of Spain.

It is a remarkable circumſtance in the hiſtory of animated Nature, that carnivorous birds and quadrupeds are leſs prolific than the inoffenſive and aſſociating kinds; but, on the contrary, that the inhabitants of the waters, who are all carnivorous, are endowed with a moſt aſtoniſhing fecundity. All kinds of fiſhes, a few only excepted, are oviparous. Notwithſtanding the amazing deſtruction of their eggs by the ſmaller fry that frequent the ſhores, by aquatic birds, and by the larger fiſhes, the numbers which eſcape are ſufficient to ſupply the ocean with inhabitants, and to afford nouriſhment to a very great portion of the human race. A cod, for inſtance, according to the accurate computation of Lewenhoeck, produces, from one roe, above nine millions of eggs in a ſingle ſeaſon. The flounder lays annually above one million, and the mackarel more than five hundred thouſand: An increaſe ſo great, if permitted to arrive at maturity, that the ocean itſelf, in a few centuries, would not be ſpacious enough to contain its animated productions. This wonderful fertility anſwers two valuable purpoſes. In the midſt of numberleſs enemies it continues the reſpective ſpecies, and furniſhes to all a proper quantity of nouriſhment.

We have thus ſeen that man, ſome quadrupeds, ſome birds, and all fiſhes, are carnivorous animals. But this ſyſtem of carnage deſcends ſtill lower. Many of the *inſect* tribes derive their nouriſhment from putrid carcaſſes, from the bodies of living animals, or from killing and devouring weaker ſpecies. How many flies are daily ſacrificed by ſpiders, a moſt voracious and a moſt numerous tribe of inſects? In return, ſpeeders are greedily devoured by flies which are diſtinguiſhed by the name of *ichneumons*. The number of theſe ichneumon flies is inconceivable; and, if it were not for the prodigious havock they make upon caterpillars and other inſects, the fruits of the earth would be entirely deſtroyed. Waſps are extremely fond of animal food. They frequent butchers ſtalls, and beat off the fleſh fly, and every other inſect that reſorts thither for the purpoſe of depoſiting its eggs in the meat. Butchers take the advantage of this jealous warfare. They encourage the waſps, and make centinels of them, by giving them livers, which they prefer to more fibrous fleſh, probably becauſe they can cut livers more eaſily with their teeth.

The libella, dragon, or lady-fly, is well known by the beauty of its colours and the ſymmetry of its form. For theſe external qualities it has received the appellation of *lady-fly*. Its diſpoſitions and its mode of life, however, are more ferocious and warlike than thoſe of the Amazones. Like birds of prey, they hover about in the air, for the ſole purpoſe of devouring almoſt every ſpecies of winged inſect. They accordingly frequent marſhy grounds, pools of water, and the margins of rivers, where inſects moſt abound. Their appetite is ſo groſs and voracious, that they not only devour ſmall flies, but even the large fleſh-fly, moths, and butterflies, of every kind.

It has been often ſaid, that no animal ſpontaneouſly feeds upon its own ſpecies. This remark has probably been intended as an apology for, or at leaſt a limitation to, the general ſyſtem of carnage eſtabliſhed by Nature. But the obſervation, whatever might have been its intention, is unhappily a reſult of ignorance; for ſome quadrupeds, all fiſhes, and many inſects, make no ſuch diſcrimination. The weaker are uniformly preyed upon by the ſtronger. Reaumur put twenty of thoſe caterpillars which feed upon the leaves of the oak into a vial. Though he regularly ſupplied them with plenty of freſh oak leaves, he obſerved that the number of dead ones daily increaſed. Upon a more attentive examination into the cauſe of this mortality, he found, that the ſtronger attacked with their teeth, killed, ſucked out the vitals of their weaker companions, and left nothing

thing but the head, feet, and empty ſkins. In a few days, one only of the twenty remained in life.

Caterpillars have myriads of external enemies, as birds of almoſt every kind, many of the ſmaller quadrupeds, their own ſpecies, and numberleſs inſects. But this vaſt ſource of devaſtation is ſtill augmented by what may be denominated their internal enemies. Many flies depoſit their eggs in the bodies of caterpillars. From theſe eggs proceed ſmall maggots, which gradually devour the vitals of the animal in which they reſide. When about to be transformed into chryſalids, they pierce the ſkin of the caterpillar, ſpin their pods, and remain on the empty ſkin till they aſſume the form of flies, and eſcape into the air to perform the ſame cruel office to another unfortunate reptile. Every perſon muſt recollect to have ſeen the colewort or cabbage caterpillar ſtuck upon old walls, or the windows of country cottages, totally covered with theſe chryſalids, which have the form of ſmall maggots, and are of a fine yellow colour. One of the moſt formidable enemies of the caterpillar is a black worm, with ſix cruſtaceous legs. It is as long, and thicker than an ordinary ſized caterpillar. In the fore part of the head it has two curved pincers, with which it quickly pierces the belly of a caterpillar, and never quits the prey till it is entirely devoured. The largeſt caterpillar is not ſufficient to nouriſh this worm for a ſingle day; for it daily kills and eats ſeveral of them. Theſe gluttonous worms, when gorged with food, become inactive, and almoſt motionleſs. When in this ſatiated condition, young worms of the ſame ſpecies attack and devour them. Of all trees, the oak, perhaps, nouriſhes the greateſt number of different caterpillars, as well as of different inſects. Amongſt others, the oak is inhabited by a large and beautiful beetle. This beetle frequents the oak, probably becauſe that tree is inhabited by the greateſt number of caterpillars. It marches from branch to branch, and, when diſpoſed for food, attacks and devours the firſt caterpillar that comes in its way.

The pucerons, vine-fretters, or plant-lice, are very injurious to trees and vegetables of almoſt every kind. Their ſpecies are ſo numerous, and all of them are endowed with ſuch a wonderful fertility, that we ſhould expect to ſee the leaves, the branches, and the ſtems of every plant totally covered with them. But this aſtoniſhing fecundity, and the devaſtation theſe ſmall inſects would unavoidably produce among the vegetable tribes, is checked by numberleſs enemies. Myriads of inſects of different claſſes, of different genera, and of different ſpecies, ſeem to be produced for no other purpoſe but to devour the pucerons. Some of theſe inſects are ſo voracious, that, notwithſtanding the extreme prolific powers of the pucerons, we have reaſon to be ſurpriſed that their ſpecies are not entirely annihilated. On every leaf inhabited by the puceron we find worms of different kinds. Theſe worms feed not upon the leaves, but upon the pucerons, whom they devour with an almoſt incredible rapacity. Some of theſe worms are transformed into flies with two wings, others into flies with four wings, and others into beetles. While in the worm-ſtate, one of theſe gluttonous inſects will ſuck out the vitals of twenty pucerons in a quarter of an hour. Reaumur ſupplied a ſingle worm with more than a hundred pucerons, every one of which it devoured in leſs than three hours.

Beſide the general ſyſtem of carnage produced by the neceſſity of one animal's feeding upon another, there are other ſources of deſtruction, which originate from very different motives. Man is not the only animal who wages war with his own ſpecies. War among mankind, in certain accidental ſituations of ſociety, may be productive, to particular nations or communities, of beneficial effects. But every advantage derived by war to one nation is acquired at the expence,

pence, and either the partial or the total ruin of another. If univerſal peace could be completely eſtabliſhed, and if the earth were cultivated to the higheſt perfection, it is not probable that the multiplication of the human ſpecies would ever riſe to ſuch a degree as to exceed the quantity of proviſions produced by agriculture, and by the breeding of domeſtic animals, neceſſary for their exiſtence and happineſs. But, as long as men are actuated by ambition, by reſentment, and by many other hoſtile paſſions, war and animoſity, with all their train of blood-ſhed and calamity, will forever continue to harraſs and perſecute the human kind. Let us, however, be humble. We cannot unfold the myſteries of Nature; but we may admire her operations, and ſubmit, with a becoming reſignation, to her irreſiſtible decrees. The man, if ſuch a man there be, whoſe ſtrength of mind enables him to obſerve ſteadfaſtly this conduct, is the only real philoſopher.

As formerly remarked, man is not the only animal that makes war with his own ſpecies. Quadrupeds, birds, fiſhes, inſects, independently of their appetite for food, occaſionally fight and kill each other. On this ſubject we ſhall confine ourſelves to a few examples derived from the inſect tribes.

A ſociety or hive of bees conſiſts of a female, of males, and of drones, or neuters. Theſe three kinds continue, for ſome time, in the moſt perfect harmony, and mutually protect and aſſiſt each other. The neuters, or working bees, diſcover the ſtrongeſt attachment and affection to the males, even when in their worm ſtate. The neuters are armed with a deadly ſting, of which the males are deſtitute. Both are equally produced by the ſame mother, and live in the ſame family. But, notwithſtanding their temporary affection, there are times when the neuters cruelly maſſacre the males. Among the laws of poliſhed republics, we find ſome which are extremely barbarous.

The Lacedemonians were allowed to kill ſuch of their children as were produced in a defective or maimed ſtate, becauſe they would become a burden upon the community. The laws of the Chineſe permit actions equally inhuman. We perhaps know not all the reaſons why the neuter bees treat the males with ſo much cruelty. There is a time, however, when the males become perfectly uſeleſs to the community; and it is not incurious to remark, that the general maſſacre never commences till this period arrives. Whenever a ſtranger bee enters a hive, his temerity is uniformly puniſhed with death. But mortal combats are not unfrequent between bees belonging to the ſame hive. Theſe combats are moſt frequent in clear and warm weather. Sometimes two combatants come out of the hive cloſely faſtened to each other. At other times the attack is made in the air. But, in whatever way the battle begins, both combatants uniformly come to the ground before it is terminated by the death of one of the parties. When they reach the ground, each individual, like a wreſtler, endeavours to gain the moſt advantageous poſition for ſtinging his adverſary to death. Sometimes, though rarely, the ſting is left in the wound. If this were generally the caſe, every combat would prove fatal to two bees; for the victor could not long ſurvive the loſs of his ſting. Theſe battles ſometimes continue near an hour before one of the flies is left expiring on the ground.

Beſide theſe ſingle combats, general actions are not unfrequent, eſpecially in the ſwarming ſeaſon. When two ſwarms, or colonies, happen to contend for the ſame habitation, a general and bloody engagement immediately enſues. Theſe engagements often continue for hours, and never terminate without great havock on both ſides. The ſting is not the only weapon employed in war by bees. They are furniſhed with two ſtrong fangs or teeth, with which they cruelly tear each other. Even in general engagements, all the combats are ſingle. But, when the great ſlaughter of the males is committing, three or four neuters are not aſhamed to attack a ſingle fly.

Every waſp's neſt, about the beginning of October, exhibits a ſingular and a cruel ſcene. At this ſeaſon, the waſps ceaſe to bring nouriſhment to their young. From affectionate mothers or nurſes, they at once become barbarous ſtepmothers. They are worſe; for they drag the young worms from their cells, and carry them out of the neſt. Being thus expoſed to the weather, and deprived of nouriſhment, every one of them unavoidably periſhes. This devaſtation is not, like that of the honey-bees, confined to the male-worms. Here no worm, of whatever denomination or ſex, eſcapes the general and undiſtinguiſhing maſſacre. Beſide expoſing the worms to the weather, the waſps kill them with their fangs. This fact ſeems to be a violation of parental affection, one of the ſtrongeſt principles in animal nature. But the intentions of Nature, though they may often elude our reſearches, are never wrong. What appears to us cruel and unnatural in this inſtinctive devaſtation committed annually by the waſps, is perhaps an act of the greateſt mercy and compaſſion. Waſps are not, like the honey-bees, endowed with the inſtinct of laying up a ſtore of proviſions for winter ſubſiſtence. If not prematurely deſtroyed by their parents, the young muſt neceſſarily die a more cruel and lingering death, occaſioned by hunger. Hence this ſeemingly harſh conduct in the oeconomy of waſps, inſtead of affording an exception to the univerſal benevolence and wiſdom of Nature, is, in reality, a merciful inſtitution. Beſides, as the multiplication of waſps is prodigious, and as they are a noxious race both to man and other animals, and eſpecially to many tribes of inſects, if their increaſe were not checked by ſuch a dreadful carnage, their depredations, in a few years, would annihilate other ſpecies, break the chain of Nature, and even prove deſtructive to man and the larger animals.

The ſame inſtinctive ſlaughter, and probably for the ſame reaſons, is made by the hornets. Towards the end of October, all the worms and nymphs are dragged out of the neſt and killed. The neuters and males fall daily victims to the cold; ſo that, at the end of winter, a few fertile females only remain to continue the ſpecies.

According to the adopted plan, we ſhall finiſh this ſubject with ſome obſervations which may have a tendency to reconcile our minds to a ſyſtem ſo deſtructive to individuals of every ſpecies, that humanity, when not enlightened by a ray of philoſophy, is apt to revolt, and to brand Nature with cruelty and oppreſſion. Nature, it muſt be confeſſed, ſeems almoſt indifferent to individuals, who periſh every moment in millions, without any apparent compunction. But, with regard to ſpecies of every deſcription, her uniform and uninterrupted attention to the preſervation and continuation of the great ſyſtem of animation is conſpicuous, and merits admiration. Life, it ſhould appear, cannot be ſupported without the intervention of death. Through almoſt the whole of animated Nature, as we have ſeen, nothing but rapine, and the deſtruction of individuals, prevail. This deſtruction, however, has its uſe. Every animal, after death, adminiſters life and happineſs to a number of others. In many animals, the powers of digeſtion, and of aſſimilation, are confined to animal ſubſtances alone. If deprived of animal food, ſuch ſpecies, it is evident, could not exiſt. The chief force of this obſervation, it is admitted, is applicable ſolely to the carnivorous tribes, ſtrictly ſo denominated. But, from the facts formerly enumerated, and from the daily experience of every man, it is apparent, that, perhaps, no animal does or can exiſt totally independent of food that is or has been animated. Sheep, oxen, and all herbivorous animals, though not from choice, and even without conſciouſneſs, daily devour thouſands of inſects. This may be one reaſon why cattle of all kinds fatten ſo remarkably in rich paſtures; for inſects are always moſt numerous where the herbage is luxuriant. Nature is ſo profuſe in her animated productions, that no food can be eat, and no fluid can be drunk, in which animal ſubſtances, either in a living or dead ſtate, are not to be found.

To this reaſoning it may be objected, Why has Nature eſtabliſhed a ſyſtem ſo cruel? Why did ſhe render it neceſſary that one animal could not live without the deſtruction of another? To ſuch queſtions no anſwer can be either given or expected. No being, except the Supreme, can unfold this myſtery. Perhaps it even exceeds the limits of poſſibility to eſtabliſh ſuch an extended ſyſtem of animation upon any other foundation. From the general benevolence of the great Creator, we are warranted to conclude that this is really the caſe. But it is fruitleſs to dwell upon ſubjects which are inſcrutable, and far removed beyond the powers of human intellect. We ſhall therefore deſcend, and endeavour to point out ſome advantages which reſult from this myſterious inſtitution of Nature.

On this branch of the ſubject, the reader will eaſily perceive that much order or connection is not to be expected.

The hoſtilities of animals, mankind not excepted, give riſe to mutual improvement. Animals improve, and diſcover a ſuperiority of parts, in proportion to the number of enemies they have to attack or evade. The weak, and conſequently timid, are obliged to exert their utmoſt powers in inventing and practiſing every poſſible mode of eſcape. Pure inſtinct powerfully prompts; but much is learned by experience and obſervation. Rapacious animals, on the contrary, by frequent diſappointment, are obliged to provide againſt the cunning and alertneſs of their prey. Herbivorous animals, as they have little difficulty in procuring food, are proportionally ſtupid; but they would be ſtill more ſtupid, if they had no enemies to annoy them.

Man, if his attention and talents were not excited by the animoſities of his own ſpecies, by the attacks of ferocious animals, and even by thoſe of the inſect tribes, would be an indolent, an incurious, a dirty, and an ignorant animal. Thoſe of the human race, accordingly, who procure their food with little or no induſtry, as we learn from a multitude of travellers and voyagers, are perfectly indolent and brutiſhly ſtupid. Timid animals never uſe the arts of defence, or provide againſt danger, except from three cauſes, pure inſtinct, which is implanted in their natures, imitation, and experience. By experience, timid animals are taught the arts of evaſion. Flight is inſtinctive; but the modifications of it are acquired by imitation and experience.

Hoſtilities, in ſome inſtances, ſeem to ariſe, not from a natural antipathy of one ſpecies to another, but from a ſcarcity of food. The celebrated Captain Cooke informs us, that, in Staten Iſland, birds of prey aſſemble promiſcuouſly with penguins and other birds, without the one offering any injury, or the other diſcovering the ſmalleſt ſymptom of terror. In that iſland, the rapacious birds, perhaps, find plenty of food from dead ſeals, ſea-lions, and fiſhes.

A profuſion of animal life ſeems to be the general intention of Nature. For this purpoſe, when not modified or reſtrained by the induſtry and intelligence of man, ſhe uniformly covers the ſurface of the earth with trees and vegetables of every kind, which ſupply myriads of animated beings with food. But the greateſt poſſible extention of life would ſtill be wanting, if animals did not prey upon each other. If all animals were to live upon vegetables alone, many ſpecies, and millions of individuals, which now enjoy life and happineſs, could have no exiſtence; for the productions of the earth would not be ſufficient to ſupport them. But, by making animals feed upon each other, the ſyſtem of animation and of happineſs is extended to the greateſt poſſible degree. In this view, Nature, inſtead of being cruel and oppreſſive, is highly generous and beneficent.

To diminiſh the number of noxious animals, and to augment that of uſeful vegetables, has been the uniform ſcope of human induſtry. A few ſpecies of animals only are of immediate utility to man. Theſe he either cultivates with care, or hunts for his prey. The ox, the ſheep, the goat, and other animals which are under his peculiar protection, he daily uſes for food. This is not cruelty. He has a right to eat them: For, like Nature, though he occaſionally deſtroys domeſtic animals, a timid and docile race of beings, by his culture and protection he gives life and happineſs to millions, which, without his aid, could have no exiſtence. The number of individuals, among animals of this deſcription, if they were not cheriſhed and defended by man, would be extremely limited; for, by the mildneſs of their diſpoſitions, the comparative weakneſs of their arms, and the univerſal and ſtrong appetite for them by rapacious quadrupeds and birds of prey, though the ſpecies might, perhaps, be continued, the number of individuals would, of neceſſity, be very ſmall.

There is a wonderful balance in the ſyſtem of animal deſtruction. If the general profuſion of the animated productions of Nature had no other check than the various periods to which their lives, when not extinguiſhed by hoſtilities of one kind or another, are limited, the whole would ſoon be annihilated by an univerſal famine, and the earth, inſtead of every where teeming with animals, would, unleſs re-peopled by a new creation, exhibit nothing but a mute, a lifeleſs, and an inactive ſcene. If even a ſingle ſpecies were permitted to multiply without diſturbance, the food of other ſpecies would be exhauſted, and, of courſe, a period would be put to their exiſtence. The herbivorous and frugivorous races, if not reſtrained by the carnivorous, would ſoon increaſe to a hurtful degree. Carnivorous animals are the barriers fixed by Nature to noxious inundations of other kinds. The carnivorous tribes may be compared to the hoe and the pruning hook, which, by diminiſhing the number of plants when too cloſe, or lopping off their luxuriancies, make the others grow to greater perfection. To thoſe ſwarms of inſects which cover the ſurface of the earth, are oppoſed an army of birds, an active, a vigilant, and a voracious race. Hares, rabbits, mice, rats, are expoſed to the depredations of carnivorous quadrupeds and birds. The larger cattle, as the ox, the deer, the ſheep, &c. are not exempted from enemies: And man, by the ſuperiority of his mental powers, checks the multiplication of the carnivorous tribes, and maintains the balance and empire of the animal ſyſtem. Thoſe ſpecies which are endowed with uncommon fertility have the greateſt number of enemies. The caterpillar, the puceron, and inſects in general, one of the moſt prolific tribes of animals, are attacked and devoured by numerous hoſtile bands. No ſpecies, however, is ever exhauſted. The balance between gain and loſs is perpetually preſerved. The earth, the ſeas, the atmoſphere, may be conſidered as an immenſe and variegated paſture. In this view, it is moſt judiciouſly cultivated and ſtocked by the numerous animated beings which it is deſtined to ſupport. Every animal and every vegetable furniſh ſubſiſtence to particular ſpecies. Thus, nothing of value is loſt; and every ſpecies is abundantly ſupplied with food.

That the general balance of animation is conſtantly preſerved, we learn from daily experience. The reader, however, I preſume, will not be diſpleaſed to have ſome examples of the modes employed by Nature to accompliſh this effect ſuggeſted to him.

After an inundation of the Nile, the lower parts of Egypt are greatly infeſted with ſerpents, frogs, mice, and other vermin. At that period, the ſtorks reſort thither in immenſe multitudes, and devour the ſerpents, frogs, and mice, which, without this dreadful carnage, would be highly noxious to the inhabitants. Belon, a moſt ingenious and faithful French naturaliſt, remarks, that, in many places, the land could not be inhabited, if the ſtorks did not deſtroy the amazing numbers of mice which frequently appear in Paleſtine, and other parts of the Eaſt bordering upon Egypt. The Egyptian vulture, ſays Haſſelquiſt, is of ſingular benefit to that country. It eats up all the dung and off-falls in the towns, and the carcaſſes of camels, horſes, aſſes, &c. in the fields, which, if not quickly devoured, would, in that warm climate, by their putreſcency, be productive of diſeaſe and death to the inhabitants. Putrid carcaſſes, in all countries, are both offenſive to the noſtrils and hurtful to health. But Nature, by various inſtruments, ſoon removes the evil. An animal no ſooner dies, than, in a very ſhort time, he is conſumed by bears, wolves, foxes, dogs, and ravens. In ſituations where theſe animals dare not approach, as in the vicinity of towns and villages, a dead horſe, in a few days, is devoured by myriads of maggots. In the uncultivated parts of America, ſerpents and ſnakes of different kinds abound. After it was diſcovered that ſwine greedily devoured ſerpents, hogs were uniformly kept by all new ſettlers. Caterpillars are deſtructive to the leaves and fruits of plants. Their numbers and varieties are immenſe. But their devaſtations are checked by many enemies. Without a profuſion of caterpillars, moſt of the ſmaller birds, eſpecially when young, could not be ſupported. By devouring the caterpillars, theſe birds preſerve the fruits of the earth from total deſtruction. Mr Bradley, in his general treatiſe of huſbandry and gardening, has publiſhed a letter, in which the author oppoſes the common opinion, that birds, and particularly ſparrows, do much miſchief in our gardens and fields. The fact is admitted. But the great utility of theſe birds is overlooked: For this author proves, that they are much more uſeful than noxious. He ſhows, that a pair of ſparrows, during the time they have their young to feed, deſtroy, every week, 3360 caterpillars. This calculation he founded upon actual obſervation. He diſcovered that the two parents carried to the neſt 40 caterpillars in an hour. He then ſuppoſes, which is a moderate ſuppoſition, that the ſparrows enter the neſt only 12 hours each day, which is a daily conſumption of 480 caterpillars. This ſum, multiplied by 7, or the days of a week, gives 3360 caterpillars extirpated weekly from a garden. The utility of theſe birds is not limited to this circumſtance alone; for they likewiſe feed their young with butterflies, and other winged inſects, each of which, if not deſtroyed in this manner, would be the parent of ſeveral hundreds of caterpillars. Thoſe butterflies and caterpillars which are covered with hair are rejected by ſome birds, who prefer flies of a ſmoother and ſmaller kind. But theſe hairy ſpecies, it ſhould be conſidered, are the food of the worms which are transformed into thoſe ſmaller flies that afford nouriſhment to the birds which reject the hairy caterpillars and butterflies.

Shell-fiſhes are extremely prolific, and ſo ſtrongly fortified by Nature, that their increaſe, one ſhould imagine, would ſoon augment to a degree that might be hurtful to other ſpecies. Their noxious multiplication, however, is checked by numberleſs enemies. But their moſt deſtructive enemy is the trochus, which is a kind of ſea-ſnail. This animal is furniſhed with a ſtrong, muſcular, hollow trunk, bordered at the extremity with a cartilage toothed like a ſaw. Againſt this inſtrument, which acts like an augre, no ſhell, however hard or thick, is a ſufficient defence. Theſe animals, called *trochi*, fix themſelves upon an oyſter or a muſcle, bore through the ſhell with their trunk, and devour their prey at their leiſure. The animal attacked, if a bivalve, may open or ſhut its ſhell; but no efforts of this kind can be of any avail; for the trochus remains immoveably fixed till it has completely ſucked out the vitals of its prey. In this cruel occupation the trochus often continues for days, and even weeks, before the life of the animal attacked is fully extinguiſhed. The operation of the trochus may be ſeen in the ſhells of many oyſters, muſcles, and other ſhell-fiſhes; for their ſhells are often pierced with a number of circular holes.

The amazing ſize and ſtrength of the whale, one ſhould imagine, would ſecure it from the inſults of every other animal. But, beſide the annual depredations made by man upon the cetaceous tribes, they are often attacked and killed by the ſword-fiſh. The ſnout of this comparatively ſmall animal is armed with a long, hard, projection of bone, each edge of which is furniſhed with a number of ſtrong, flat, and ſharp points, or teeth, ſome of which, eſpecially near the ſnout, are an inch and a half in length. With this inſtrument the ſword-fiſh boldly attacks the whale. I have often had the pleaſure, ſays Pere Labat *, of ſeeing their combats. The whale has no other defence but its tail, with which it endeavours to ſtrike its antagoniſt. But, as the ſword-fiſh is more active and nimble than the whale, he eaſily parries the blow by ſpringing into the air, and renewing the attack with his ſaw-like inſtrument. Whenever he ſucceeds, the ſea is dyed red with the blood iſſuing from the wound. The fury of the whale appears from the vehemence with which it laſhes the waters, each ſtroke reſounding like the report of a cannon.

Many ſmall birds, and particularly the wren and the tit-mouſe, may be ſeen, during the winter-ſeaſon, pecking at the buds and branches of trees in our gardens. To theſe little animals Nature has entruſted the charge of preventing the noxious multiplication of thoſe worms which feed upon fruits. Nature, as far as we are able to

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* Nouv. Voyage, tom. 6. pag. 150.

to trace her operations, does nothing in vain, or without ſome valuable intention. No animals exiſt which are not uſeful, either by affording nouriſhment to, or preventing the hurtful increaſe of other ſpecies.

Upon the whole, every animated being that inhabits this globe ſeems to be deſtined by Nature, not for its own individual exiſtence and happineſs alone, but likewiſe for the exiſtence and happineſs of other animated beings. A circle of animation and of deſtruction goes perpetually round. This is the oeconomy of Nature. Different ſpecies of animals live by the mutual deſtruction of each other. Even among individual men, the ſtrong too often oppreſs the weak; but, on the other hand, the wiſe inſtruct the ignorant. Theſe are the bonds of ſociety, and the ſources of improvement.

CHAPTER XV.

Of the Artifices of Animals.

IT will be recollected, that many inſtances of the dexterity and artifices employed by different animals in various parts of their manners and oeconomy, have been occaſionally mentioned in ſeveral of the foregoing chapters. This circumſtance, to avoid repetitions, will neceſſarily render the preſent chapter proportionally ſhort.

The artifices practiſed by animals proceed from ſeveral motives, many of which are purely inſtinctive, and others are acquired by experience and imitation. Their arts, in general, are called forth and exerted by three great and important cauſes, the love of life, the deſire of multiplying and continuing the ſpecies, and that ſtrong attachment which every animal has to its offspring. Theſe are the ſources from which all the movements, all the dexterity, and all the ſagacity of animals originate. The principle of ſelf-preſervation is inſtinctive, and ſtrongly impreſſed upon the minds of all animated beings. It gives riſe to innumerable arts of attack and defence, and not unfrequently to ſurpriſing exertions of ſagacity and genius. The ſame remark is applicable to the deſire of multiplication, and to parental affection. Upon this ſubject we ſhall, as uſual, give ſome examples of animal artifice, which may both amuſe and inform ſome readers.

When a bear, or other rapacious animal, attacks cattle, they inſtantly join and form a phalanx for mutual defence. In the ſame circumſtances, horſes rank up in lines, and beat off the enemy with their heels. Pontopidon tells us, that the ſmall Norwegian horſes, when attacked by bears, inſtead of ſtriking with their hind-legs, rear, and, by quick and repeated ſtrokes with their fore-feet, either kill the enemy, or oblige him to retire. This curious, and generally ſucceſsful defence, is frequently performed in the woods, while a traveller is ſitting on the horſe's back. It has often been remarked, that troops of wild horſes, when ſleeping either in plains or in the foreſt, have always one of their number awake, who acts as a centinel, and gives notice of any approaching danger.

Margraaf informs us, that the monkeys in Brazil, while they are ſleeping on the trees, have uniformly a centinel to warn them of the approach of the tiger or other rapacious animals; and that, if ever this centinel is found ſleeping, his companions inſtantly tear him in pieces for his neglect of duty. For the ſame purpoſe, when a troop of monkeys are committing depredations on the fruits of a garden, a centinel is placed on an eminence, who, when any perſon appears, makes a certain chattering noiſe, which the reſt underſtand to be a ſignal for retreat, and immediately fly off and make their eſcape.

The deer-kind are remarkable for the arts they employ in order to deceive the dogs. With this view the ſtag often returns twice or thrice upon his former ſteps. He endeavours to raiſe hinds or younger ſtags to follow him, and to draw off the dogs from the immediate object of their purſuit. If he ſucceeds in this attempt, he then flies off with redoubled ſpeed, or ſprings off at a ſide, and lies down on his belly to conceal himſelf. When in this ſituation, if by any means his foot is recovered by the dogs, they purſue him with more advantage, becauſe he is now conſiderably fatigued. Their ardour increaſes in proportion to his feebleneſs; and the ſcent becomes ſtronger as he grows warm. From theſe circumſtances the dogs augment their cries and their ſpeed; and, though the ſtag employs more arts of eſcape than formerly, as his ſwiftneſs is diminiſhed, his doublings and artifices become gradually leſs effectual. No other reſource is now left him but to fly from the earth which he treads, and go into the waters, in order to cut off the ſcent from the dogs, when the huntſmen again endeavour to put them on the track of his foot. After taking to the water, the ſtag is ſo much exhauſted that he is incapable of running much farther, and is ſoon *at bay*, or, in other words, turns and defends himſelf againſt the hounds. In this ſituation he often wounds the dogs, and even the huntſmen, by blows with his horns, till one of them cuts his hams to make him fall, and then puts a period to his life. The fallow-deer is more delicate, leſs ſavage, and approaches nearer to the domeſtic ſtate than the ſtag. The males, during the rutting ſeaſon, make a bellowing noiſe, but with a low and interrupted voice. They are not ſo furious as the ſtag. They never depart from their own country in queſt of females; but they bravely fight for the poſſeſſion of their miſtreſſes. They aſſociate in herds, which generally keep together. When great numbers are aſſembled in one park, they commonly form themſelves into two diſtinct troops, which ſoon become hoſtile, becauſe they are both ambitious of poſſeſſing the ſame part of the incloſure. Each of theſe troops has its own chief or leader, who always marches foremoſt, and he is uniformly the oldeſt and ſtrongeſt of the flock. The others follow him; and the whole draw up in order of battle, to force the other troop, who obſerve the ſame conduct, from the beſt paſture. The regularity with which theſe combats are conducted is ſingular. They make regular attacks, fight with courage, and never think themſelves vanquiſhed by one check; for the battle is daily renewed till the weaker are completely defeated, and obliged to remain in the worſt paſture. They love elevated and hilly countries. When hunted, they run not ſtraight out, like the ſtag, but double, and endeavour to conceal themſelves from the dogs by various artifices, and by ſubſtituting other animals in their place. When fatigued and heated, however, they take the water, but never attempt to croſs ſuch large rivers as the ſtag. Thus, between the chace of the fallow-deer and of the ſtag, there is no material difference. Their ſagacity and inſtincts, their ſhifts and doublings, are the ſame, only they are more frequently practiſed by the fallow-deer. As he runs not ſo far before the dogs, and is leſs enterpriſing, he has oftener occaſion to change, to ſubſtitute another in his place, to double, return upon his former tracks, &c. which renders the hunting of the fallow-deer more ſubject to inconveniencies than that of the ſtag.

The roe-deer is inferior to the ſtag and fallow-deer both in ſtrength and ſtature; but he is endowed with more gracefulneſs, courage, and vivacity. His eyes are more brilliant and animated. His limbs are more nimble; his movements are quicker, and he bounds with equal vigour and agility. He is likewiſe more crafty, conceals himſelf with greater addreſs, and derives ſuperior reſources from his inſtincts. Though he leaves behind him a ſtronger ſcent than the ſtag, which increaſes the ardour of the dogs, he knows how to evade their purſuit, by the rapidity with which he commences his flight, and by his numerous doublings. He delays not his arts of defence till his ſtrength begins to fail him; for he no ſooner perceives that the firſt efforts of a rapid flight have been unſucceſsful, than he repeatedly returns upon his former ſteps; and, after confounding, by theſe oppoſite motions, the direction he has taken, after intermixing the preſent with the paſt emanations of his body, he, by a great bound, riſes from the earth, and, retiring to a ſide, lies down flat on his belly. In this immoveable ſituation, he often allows the whole pack of his deceived enemies to paſs very near him. The roe-deer differs from the ſtag in diſpoſition, manners, and in almoſt every natural habit. Inſtead of aſſociating in herds, they live in ſeparate families. The two parents and the young go together, and never mingle with ſtrangers. They are conſtant in their amours, and never unfaithful like the ſtag. The females commonly produce two fawns, the one a male and the other a female. Theſe young animals, who are brought up and nouriſhed together, acquire a mutual affection ſo ſtrong, that they never depart from each other. This attachment is ſomething more than love; for, though always in company, they feel the rut but once a year, and it continues only fifteen days. At this period the father drives off the fawns, as if he intended that they ſhould yield their place to thoſe which are to ſucceed, in order to form new families for themſelves. After the rutting ſeaſon, however, is paſt, the fawns return to their mother, and continue with her ſome time longer; after which they ſeparate forever, and remove to a diſtance from the place of their nativity. When about to bring forth, the female ſeparates from the male; and, to avoid the wolf, her moſt dangerous enemy, conceals herſelf in the deepeſt receſſes of the foreſt. In a week or two the fawns are able to follow her. When threatened with danger, ſhe hides them in a cloſe thicket; and, ſo ſtrong is her parental affection, that, in order to preſerve her offspring from deſtruction, ſhe preſents herſelf to be chaced.

Hares poſſeſs not, like rabbits, the art of digging retreats in the earth. But they neither want inſtinct ſufficient for their own preſervation, nor ſagacity for eſcaping their enemies. They form ſeats or neſts on the ſurface of the ground, where they watch, with the moſt vigilant attention, the approach of any danger. In order to

deceive,

deceive, they conceal themſelves between clods of the ſame colour with that of their own hair. When purſued, they firſt run with rapidity, and then double, or return upon their former ſteps. From the place of ſtarting, the females run not ſo far as the males; but they double more frequently. Hares hunted in the place where they were brought forth, ſeldom remove to a great diſtance from it, but return to their form; and, when chaced two days ſucceſſively, on the ſecond day they perform the ſame doublings they had practiſed the day before. When hares run ſtraight out to a great diſtance, it is a proof that they are ſtrangers. Male hares, eſpecially during the moſt remarkable period of rutting, which is in the months of January, February, and March, ſometimes perform journies of ſeveral miles in queſt of mates; but, as ſoon as they are ſtarted by dogs, they fly back to the place of their nativity. ‘ I have ſeen a hare,’ Fouilloux remarks, ‘ ſo ſagacious, that, after hearing the hunter's horn, he ‘ ſtarted from his form, and, though at the diſtance of a quarter of a ‘ league, went to ſwim in a pool, and lay down on the ruſhes in the ‘ middle of it, without being chaced by the dogs. I have ſeen a ‘ hare, after running two hours before the dogs, puſh another from ‘ his ſeat, and take poſſeſſion of it. I have ſeen others ſwim over ‘ two or three ponds, the narroweſt of which was eighty paces broad. ‘ I have ſeen others, after a two hours chace, run into a ſheep-fold ‘ and lie down among them. I have ſeen others, when hard puſhed, ‘ run in among a flock of ſheep, and would not leave them. I have ‘ ſeen others, after hearing the noiſe of the hounds, conceal them‘ſelves in the earth. I have ſeen others run up one ſide of a hedge ‘ and return by the other, when there was nothing elſe between them ‘ and the dogs. I have ſeen others, after running half an hour, ‘ mount an old wall, ſix feet high, and clap down in a hole covered ‘ with ivy. Laſtly, I have ſeen others ſwim over a river, of about ‘ eighty paces broad, oftener than twice, in the length of two hun‘dred paces.’

The fox has, in all ages and nations, been celebrated for craftineſs and addreſs. Acute and circumſpect, ſagacious and prudent, he diverſifies his conduct, and always reſerves ſome art for unforeſeen accidents. Though nimbler than the wolf, he truſts not entirely to the ſwiftneſs of his courſe. He knows how to enſure ſafety, by providing himſelf with an aſylum, to which he retires when danger appears. He is not a vagabond, but lives in a ſettled habitation and in a domeſtic ſtate. The choice of ſituation, the art of making and rendering a houſe commodious, and of concealing the avenues which lead to it, imply a ſuperior degree of ſentiment and reflection. The fox poſſeſſes theſe qualities, and employs them with dexterity and advantage. He takes up his abode on the border of a wood, and in the neighbourhood of cottages. Here he liſtens to the crowing of the cocks and the noiſe of the poultry. He ſcents them at a diſtance. He chooſes his time with great judgment and diſcretion. He conceals both his route and his deſign. He moves forward with caution, ſometimes even trailing his body, and ſeldom makes a fruitleſs expedition. When he leaps the wall, or gets in underneath it, he ravages the court-yard, puts all the fowls to death, and then retires quietly with his prey, which he either conceals under the herbage, or carries off to his kennel. In a ſhort time he returns for another, which he carries off and hides in the ſame manner, but in a different place. In this manner he proceeds, till the light of the ſun, or ſome movements perceived in the houſe, admoniſh him that it is time to retire to his den. He does much miſchief to the bird-catchers. Early in the morning he viſits their nets and their bird-lime, and carries off ſucceſſively all the birds that happen to be entangled. The young hares he hunts in the plains, ſeizes old ones in their ſeats, digs out the rabbits in the warrens, finds out the neſts of partridges, quails, &c. ſeizes the mothers on the eggs, and deſtroys a prodigious number of game. Dogs of all kinds ſpontaneouſly hunt the fox. Though his odour be ſtrong, they often prefer him to the ſtag or the hare.

When purſued he runs to his hole; and it is not uncommon to ſend in terriers to detain him till the hunters remove the earth above, and either kill or ſeize him alive. The moſt certain method, however, of deſtroying a fox is to begin with ſhutting up the hole, to ſtation a man with a gun near the entrance, and then to ſearch about with the dogs. When they fall in with him, he immediately makes for his hole. But, when he comes up to it, he is met with a diſcharge from the gun. If the ſhot miſſes him, he flies off with full ſpeed, takes a wide circuit, and returns again to the hole, where he is fired upon a ſecond time; but, when he diſcovers that the entrance is ſhut, he darts away ſtraight forward, with the intention of never re-viſiting his former habitation. He is next purſued by the hounds, whom he ſeldom fails to fatigue; becauſe, with much cunning, he paſſes through the thickeſt part of the foreſt, or places of the moſt difficult acceſs, where the dogs are hardly able to follow him; and, when he takes to the plains, he runs ſtraight out, without either ſtopping or doubling. But the moſt effectual way of deſtroying foxes is to lay ſnares baited with live pigeons, fowls, &c. The fox is an exceedingly voracious animal. Beſide all kinds of fleſh and fiſhes, he devours, with equal avidity, eggs, milk, cheeſe, fruits, and particularly grapes. He is ſo extremely fond of honey, that he attacks the neſts of wild bees. They at firſt put him to flight by numberleſs ſtings; but he retires for the ſole purpoſe of rolling himſelf on the ground, and of cruſhing the bees. He returns to the charge ſo often, that he obliges them to abandon the hive, which he ſoon uncovers, and devours both the honey and the wax. Some time before the female brings forth, ſhe retires, and ſeldom leaves her hole, where ſhe prepares a bed for her young. When ſhe perceives that her retreat is diſcovered, and that her young have been diſturbed, ſhe carries them off, one by one, into a new habitation. The fox ſleeps in a round form, like the dog; but, when he only repoſes himſelf, he lies on his belly with his hind-legs extended. It is in this ſituation that he eyes the birds on the hedges and trees. The birds have ſuch an antipathy againſt him, that they no ſooner perceive him than they ſend forth ſhrill cries to advertiſe their neighbours of the enemy's approach. The jays and blackbirds, in particular, follow the fox from tree to tree, ſometimes two or three hundred paces, often repeating the watch-cries. The Count de Buffon kept two young foxes, which, when at liberty, attacked the poultry; but, after they were chained, they never attempted to touch a ſingle fowl. A living hen was fixed near them for whole nights; and, though deſtitute of victuals for many hours, in ſpite of hunger and of opportunity, they never forgot that they were chained, and gave the hen no diſturbance.

In Kamtſchatka, the animals called *gluttons* employ a ſingular ſtratagem for killing the fallow-deer. They climb up a tree, and carry with them a quantity of that ſpecies of moſs of which the deer are very fond. When a deer approaches near the tree, the glutton throws down the moſs. If the deer ſtops to eat the moſs, the glutton inſtantly darts down upon its back, and, after fixing himſelf firmly between the horns, tears out its eyes, which torments the animal to ſuch a degree, that, whether to put an end to its torments, or to get rid of its cruel enemy, it ſtrikes its head againſt the trees till it falls down dead. The glutton divides the fleſh of the deer into convenient portions, and conceals them in the earth to ſerve for future proviſions. The gluttons on the river Lena kill horſes in the ſame manner [*].

There are ſeveral ſpecies of rats in Kamtſchatka. The moſt remarkable kind is called *tegulchitch* by the natives. Theſe rats make neat and ſpacious neſts underground. They are lined with turf, and divided into different apartments, in which the rats depoſit ſtores of proviſions for ſupporting them during the winter. It is worthy of remark, that the rats of this country never touch the proviſions laid up for the winter, except when they cannot procure nouriſhment any where elſe. Theſe rats, like the Tartars, change their habitations. Sometimes they totally abandon Kamtſchatka for ſeveral years, and their retreat greatly alarms the inhabitants, which they conſider as a preſage of a rainy ſeaſon, and of a bad year for hunting. The return of theſe animals is, of courſe, looked upon as a good omen. Whenever they appear, the happy news is ſoon ſpread over all parts of the country. They always take their departure in the ſpring, when they aſſemble in prodigious numbers, and traverſe rivers, lakes, and even arms of the ſea. After they have made a long voyage, they frequently lie motionleſs on the ſhore, as if they were dead. When they recover their ſtrength they recommence their march. The inhabitants of Kamtſchatka are very ſolicitous for the preſervation of theſe animals. They never do the rats any injury, but give them every aſſiſtance when they lie weakened and extended on the ground. They generally return to Kamtſchatka about the month of October; and they are ſometimes met with in ſuch prodigious numbers that travellers are obliged to ſtop two hours till the whole troop paſſes. The track of ground they travel in a ſingle ſummer is not leſs wonderful than the regularity they obſerve in their march, and that inſtinctive impulſe which enables them to foreſee, with certainty, the changes of times and of ſeaſons.

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[*] Gazette Literaire, vol. 1. pag. 481.

With regard to *Birds*, their artifices are not leſs numerous nor leſs ſurpriſing than thoſe of quadrupeds. The eagle and hawk kinds are remarkable for the ſharpneſs of their ſight and the arts they employ in catching their prey. Their movements are rapid or ſlow, according to their intentions, and the ſituation of the animals they wiſh to devour. Rapacious birds uniformly endeavour to riſe higher in the air than their prey, that they may have an opportunity of darting forcibly down upon it with their pounces. To counteract theſe artifices, Nature has endowed the ſmaller and more innocent ſpecies of birds with many arts of defence. When a hawk appears, the ſmall birds, if they find it convenient, conceal themſelves in hedges or bruſh-wood. When deprived of this opportunity, they often, in great numbers, ſeem to follow the hawk, and to expoſe themſelves unneceſſarily to danger, while, in fact, by their numbers, their perpetual changes of direction, and their uniform endeavours to riſe above him, they perplex the hawk to ſuch a degree, that he is unable to fix upon a ſingle object; and, after exerting all his art and addreſs, he is frequently obliged to relinquiſh the purſuit. When in the extremity of danger, and after employing every other artifice in vain, ſmall birds have been often known to fly to men for protection. This is a plain indication that theſe animals, though they in general avoid the human race, are by no means ſo much afraid of man as of rapacious birds.

The ravens often frequent the ſea-ſhores in queſt of food. When they find their inability to break the ſhells of muſcles, &c. to accompliſh this purpoſe they uſe a very ingenious ſtratagem: They carry a muſcle, or other ſhell-fiſh, high up in the air, and then daſh it down upon a rock, by which means the ſhell is broken, and they obtain the end they had in view.

The wood-pecker is furniſhed with a very long and voluble tongue. It feeds upon ants and other ſmall inſects. Nature has endowed this bird with a ſingular inſtinct. It knows how to procure food without ſeeing its prey. It attaches itſelf to the trunks or branches of decayed trees; and, wherever it perceives a hole or crevice, it darts in its long tongue, and brings it out loaded with inſects of different kinds. This operation is certainly inſtinctive; but the inſtinct is aſſiſted by the inſtruction of the parents; for the young are no ſooner able to fly, than the parents, by the force of example, teach them to reſort to trees, and to inſert their tongues indiſcriminately into every hole or fiſſure.

Of the oeconomy of *Fiſhes*, as formerly remarked, our knowledge is extremely limited. But, as the ocean exhibits a perpetual and a general ſcene of attack and defence, the arts of aſſault and of evaſion muſt, of courſe, be exceedingly various. For the preſervation of ſome ſpecies of fiſhes, Nature has armed them with ſtrong and ſharp pikes. Others, as the perch-kind, are defended with ſtrong bony rays in their fins. Others, as the univalve ſhell-fiſh, retire into their ſhells upon the approach of danger. The bivalves and multivalves, when attacked, inſtantly ſhut their ſhells, which, in general, is a ſufficient protection to them. Some univalves, as the limpet-kind, attach themſelves ſo firmly, by excluding the air, to rocks and ſtones, that, unleſs quickly ſurpriſed, no force inferior to that of breaking the ſhell can remove them. The flying-fiſh, when purſued, darts out of the water, and takes refuge in the air, in which it is for ſome time ſupported by the operation of its large and pliable fins. The torpedo is furniſhed with a remarkable apparatus for ſelf-preſervation: It repels every hoſtile attempt by an electrical ſtroke, which confounds and intimidates its enemies. Several fiſhes, and particularly the ſalmon kind, when about to generate, leave the ocean, aſcend the rivers, depoſit their eggs in the ſand, and, after making a proper *nidus* for their future progeny, return to the ocean from whence they came. Others, as the herring-kind, though they ſeldom go up rivers, aſſemble in myriads from all quarters, and approach the ſhores, or aſcend arms of the ſea, for the purpoſe of propagating the ſpecies, and cheriſhing their offspring. When that operation is performed, they leave the coaſts and diſperſe in the ocean, till the ſame inſtinctive impulſe forces them to obſerve a ſimilar conduct next ſeaſon. This migration of ſalmons, herrings, and many other fiſhes, from the ocean to the rivers or ſhores, is of infinite advantage to mankind. They ſupply us occaſionally, and in ſome countries, as Great Britain, and particularly Scotland, with abundance of nouriſhing and luxurious food; and, if our fiſheries were once put upon a proper footing, they would ſoon conſtitute one of the moſt powerful incentives to induſtry, and become a great and important ſource of national ſtrength and proſperity.

The *inſect* tribes, though comparatively diminutive, are not deficient in artifice and addreſs. With much art the ſpider ſpins his web. It ſerves him the double purpoſe of an habitation, and of a machine for catching his food. With incredible patience and perſeverance he lies in the center of his web for days, and ſometimes for weeks, before an ill-fated fly happens to be entangled. One ſpecies of ſpider, which is ſmall, of a blackiſh colour, and frequents cottages or out-houſes, I have known to live during the whole winter months without almoſt the poſſibility of receiving any nouriſhment; for, during that period, not a fly of any kind could be diſcovered in the apartment. If they had been fixed in a torpid ſtate, like ſome other animals, the wonder of their ſurviving the want of food ſo long would not have been ſo great. But, in the ſevereſt weather, and through the whole courſe of the winter, they were perfectly active and lively. Neither did they ſeem to be in the leaſt emaciated.

The *formico-leo*, or ant-lion, is a ſmall inſect, ſomewhat reſembling a wood-louſe, but larger. Its head is flat, and armed with two fine moveable crotchets or pincers. It has ſix legs, and its body, which terminates in a point, is compoſed of a number of membranous rings. In the ſand, or in finely pulveriſed earth, this animal digs a hole in the form of a funnel, at the bottom of which it lies in ambuſh for its prey. As it always walks backward, it cannot purſue any inſect.

To ſupply this defect, it lays a ſnare for them, and eſpecially for the ant, which is its favourite food. It generally lies concealed under the ſand in the bottom of its funnel or trap, and ſeldom exhibits more than the top of its head. In digging a funnel, the formica-leo begins with tracing a circular furrow in the ſand, the circumference of which determines the ſize of the funnel, which is often an inch deep. After the firſt furrow is made, the animal traces a ſecond, which is always concentric with the firſt. It throws out the ſand, as with a ſhovel, from the ſucceſſive furrows or circles, by means of its ſquare flat head and one of its fore-legs. It proceeds in this manner till it has completed its funnel, which it does with ſurpriſing promptitude and addreſs. At the bottom of this artful ſnare it lies concealed and immoveable. When an ant happens to make too near an approach to the margin of the funnel, the ſides of which are very ſteep, the fine ſand gives way, and the unwary animal tumbles down to the bottom. The formica-leo inſtantly kills the ant, buries it under the ſand, and ſucks out its vitals. It afterwards puſhes out the empty ſkin, repairs the diſorder introduced into its ſnare, and again lies in ambuſh for a freſh prey.

We formerly took ſome notice of that ſpecies of ſpider which carries her eggs in a bag attached to her belly. A ſpider of this kind was thrown into the funnel of a formica-leo. The latter inſtantly ſeized the bag of eggs, and endeavoured to drag it under the ſand. The ſpider, from a ſtrong love of offspring, allowed its own body to be carried along with the bag. But the ſlender ſilk by which it was fixed to the animal's belly broke, and a ſeparation took place. The ſpider immediately ſeized the bag with her pincers, and exerted all her efforts to regain the object of her affections. But theſe efforts were ineffectual; for the formica-leo gradually ſunk the bag deeper and deeper in the ſand. The ſpider, however, rather than quit her hold, allowed herſelf to be buried alive. In a ſhort time, the obſerver removed the ſand, and took out the ſpider. She was perfectly unhurt; for the formica-leo had not made any attack upon her. But, ſo ſtrong was her attachment to her eggs, that, though frequently touched with a twig, ſhe would not relinquiſh the place which contained them *.

When arrived at its full growth, the formica-leo gives up the buſineſs of an enſnaring hunter. He deſerts his former habitation, and crawls about for ſome time on the ſurface of the earth. He at laſt retires under the ground, ſpins a round ſilken pod, and is ſoon transformed into a fly.

CHAP.

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* Oeuvres de Bonnet, vol. 4. pag. 295. 8vo edit. Amſterdam 1769.

CHAPTER XVI.

Of the Society of Animals.

THE aſſociating principle, from which ſo many advantages are derived, is not confined to the human ſpecies, but extends, in ſome inſtances, to every claſs of animals.

It is remarked by Buffon, and ſome other authors, that the ſtate of Nature, which had long occupied the attention and reſearches of philoſophers, was rejected by them after the diſcovery was made. In the eſtimation of the authors alluded to, the ſavage ſtate is the ſtate of Nature. The firſt natural condition of mankind is the union of a male and a female. Theſe produce a family, who, from neceſſity, or, in other words, from parental and filial affection, continue together, and aſſiſt each other in procuring food and ſhelter. This family, like moſt families in eſtabliſhed civil ſocieties, feel their own weakneſs, and their inability to ſupply their wants without more powerful reſources than their feeble exertions. When this wandering and defenceleſs family accidentally meet with another family in the ſame condition, Nature, it is ſaid, teaches them to unite for mutual ſupport and protection. The aſſociation of two families may be conſidered as the firſt formation of a tribe or nation. When a number of tribes happen to unite, they only become a larger or more numerous nation. A ſingle pair, it is true, if placed in a ſituation where plenty of food could be procured without much labour, might, in a ſucceſſion of ages, produce any indefinite number. This is preciſely the ſituation in which Moſes has placed our firſt parents. He has added another circumſtance highly favourable to a ſpeedy population. Inſtead of the preſent brevity of human life, he informs us, that men, in the firſt periods of the world, lived and propagated ſeveral hundred years.

In countries thinly peopled with ſavages, it is extremely probable, that ſocieties are formed by the gradual union of families and tribes. The increaſe of power ariſing from mutual aſſiſtance, and a thouſand other comfortable circumſtances, ſoon contribute to cement more firmly the aſſociated members. Some of the arts of life, beſide that of hunting, are occaſionally diſcovered either by accident or by the ingenuity of individuals. In this manner, gradual advances are made from the ſavage to the civilized condition of mankind. This is a very ſhort view of the origin of ſociety, which has been adopted by moſt authors both ancient and modern, though many of them have derived the aſſociating principle from very different, and even from oppoſite cauſes, which it is no part of our plan either to enumerate or refute. Some writers, as Ariſtotle, and a few moderns, implicit followers of his opinions, deny that man is naturally a gregarious or aſſociating animal. To render this notion conſiſtent with the actual and univerſal ſtate of the human race, theſe authors have had recourſe to puerile conceits, and to queſtionable facts, which it would be fruitleſs to relate. Other writers, poſſeſſed of greater judgment and diſcernment, and leſs warped with vanity and hypothetical phantoms, have derived the origin of ſociety from its real and only ſource, Nature herſelf.

That the aſſociating principle is inſtinctive hardly requires a proof. An appeal to the feelings of any human being, and to the univerſal condition of mankind, is ſufficient. Theſe feelings, it may be ſaid, are acquired by education and habit. By theſe cauſes, it is true, our ſocial feelings are ſtrengthened and confirmed; but their origin is coeval with the exiſtence of the firſt human mind. Let any man attend to the eyes, the features, and the geſtures of a child upon the breaſt, when another child is preſented to it; both inſtantly, previous to the poſſibility of inſtruction or habit, exhibit the moſt evident expreſſions of joy. Their eyes ſparkle, their features and geſtures demonſtrate, in the moſt unequivocable manner, a mutual attachment, and a ſtrong deſire of approaching each other, not with a hoſtile intention, but with an ardent affection, which, in that pure and uncontaminated ſtate of our being, does honour to human nature. When farther advanced, children who are ſtrangers to each other, though their ſocial appetite is equally ſtrong, diſcover a mutual ſhyneſs of approach. This ſhyneſs or modeſty, however, is ſoon conquered by the more powerful inſtinct of aſſociation. They daily mingle and ſport together. Their natural affections, which, at that period, are ſtrong, and unbiaſſed by thoſe ſelfiſh and vicious motives which too often conceal and thwart the intentions of Nature, create warm friendſhips that frequently continue during their lives, and produce the moſt beneficial and cordial effects. When we thus ſee with our eyes, that the aſſociating principle appears at a period much more early than many of our other inſtincts, who will liſten to thoſe writers who chooſe to deny that man is, naturally, an aſſociating or gregarious animal?

With regard to the advantages we derive from aſſociation, a volume would not be ſufficient to enumerate them. Man, from the comparatively great number of inſtincts with which his mind is endowed, neceſſarily poſſeſſes a portion of the reaſoning faculty highly ſuperior to that of any other animal. He alone enjoys the power of communicating and expreſſing his ideas by articulate and artificial language. This ineſtimable prerogative is, perhaps, one of the greateſt ſecondary bonds of ſociety, and the greateſt ſource of improvement to the human intellect. Without artificial language, though Nature has beſtowed on every animal a mode of expreſſing its wants and deſires, its pleaſures and pains, what an humiliating figure would the human ſpecies exhibit, even upon the ſuppoſition that they did aſſociate? But, when language and aſſociation are conjoined, the human intellect, in the progreſs of time, arrives at a high degree of perfection. Society gives riſe to virtue, honour, government, ſubordination, arts, ſcience, order, happineſs. All the individuals of a community conduct themſelves upon a regulated ſyſtem. Under the influence of eſtabliſhed laws, kings and magiſtrates, by the exerciſe of legal authority, encourage virtue, repreſs vice, and diffuſe, through the extent of their juriſdictions, the happy effects of their adminiſtration. In ſociety, as in a fertile climate, human talents germinate and are expanded; the mechanical and liberal arts flouriſh; poets, orators, hiſtorians, philoſophers, lawyers, phyſicians, and theologians, are produced. Theſe truths are pleaſant; and it were to be wiſhed that no evils accompanied them. But, through the whole extent of Nature, it ſhould appear, from our limited views, that good and evil, pleaſure and pain, are neceſſary and perpetual concomitants.

The advantages of ſociety are immenſe and invaluable. But the inconveniencies, hardſhips, injuſtice, oppreſſions, and cruelties, which too often originate from it are great and lamentable. Even under the mildeſt and beſt regulated governments, animoſities, jealouſies, avarice, fraud, and chicane, are unfortunately never removed from our obſervation. In abſolute monarchies, and particularly in deſpotic governments, the ſcenes of private and of general calamity and diſtreſs are often too dreadful to be deſcribed. Notwithſtanding all theſe diſadvantages, however, any government is preferable to anarchy; and the comforts, pleaſures, and improvements, we receive from aſſociating with each other, overbalance all the evils to which ſociety gives riſe.

From an attentive obſervation of the manners and oeconomy of animals, ſociety has been diſtinguiſhed into two kinds, which have been called *proper*, and *improper*. 1. *Proper Societies*, comprehend all thoſe animals who not only live together in numbers, but carry on certain operations which have a direct tendency to promote the welfare and happineſs of the community. 2. *Improper Societies*, include all thoſe animals who herd together, and love the company of each other, without carrying on any common operations.

1. *Proper Societies.*—It is almoſt needleſs to remark that man holds the firſt rank in animal aſſociations of this kind. If men did not aſſiſt each other, no operation of any magnitude, or which could ſhow any great ſuperiority of talents above thoſe of the brute creation, could poſſibly be effected. A ſingle family, or even a few families united, like other carnivorous animals, might hunt their prey, and procure a ſufficient quantity of food. They might, like the bear, lodge in the cavities of trees; they might occupy natural caves in the rocks; they might even build huts with branches of trees and with turf, and cement theſe groſs materials with clay. This loweſt and moſt abject view of human nature is not exaggerated. It were to be wiſhed that this grovelling condition of mankind were fictitious, and that, in many regions of the globe, it did not, at this moment, exiſt. Theſe operations of men, when only acquainted with the mere rudiments of ſociety, indicate parts little ſuperior to thoſe of the brutes. Man, even in his moſt uninformed ſtate, poſſeſſes the inſtincts, or the germs, of every ſpecies of knowledge and of genius.

But they muſt be cheriſhed, expanded, and brought gradually to perfection. It is by numerous and regularly eſtabliſhed ſocieties alone that ſuch glorious exhibitions of human intellect can be produced. What is the hut of a ſavage when compared to the palace of a prince? or what his canoe when compared to a firſt rate ſhip of war?

Next to the intelligence exhibited in human ſociety, that of the beavers is the moſt conſpicuous. Their operations in preparing, faſhioning, and tranſporting, the heavy materials for building their winter habitations, as formerly remarked *, are truly aſtoniſhing; and, when we read their hiſtory, we are apt to think that we are peruſing the hiſtory of man in a period of ſociety not inconſiderably advanced. It is only by the united ſtrength, and co-operation of numbers, that the beavers could be enabled to produce ſuch wonderful effects; for, in a ſolitary ſtate, as they at preſent appear in ſome northern parts of Europe, the beavers, like ſolitary ſavages, are timid and ſtupid animals. They neither aſſociate, nor attempt to conſtruct villages, but content themſelves with digging holes in the earth. Like men under the oppreſſion of deſpotic governments, the ſpirit of the European beavers is depreſſed, and their genius is extinguiſhed by terror, and by a perpetual and neceſſary attention to individual ſafety. The northern parts of Europe are now ſo populous, and the animals there are ſo perpetually hunted for the ſake of their furs, that they have no opportunity of aſſociating; of courſe, thoſe wonderful marks of their ſagacity, which they exhibit in the remote and uninhabited regions of North America, are no longer to be found. The ſociety of beavers is a ſociety of peace and of affection. They never quarrel or injure one another, but live together in different numbers, according to the dimenſions of particular cabins, in the moſt perfect harmony. The principle of their union is neither mo-

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* See above, page 313, &c.

narchical nor deſpotic. For the inhabitants of the different cabins, as well as thoſe of the whole village, ſeem to acknowledge no chief or leader whatever. Their aſſociation preſents to our obſervation a model of a pure and perfect republic, the only baſis of which is mutual and unequivocal attachment. They have no law but the law of love and of parental affection. Humanity prompts us to wiſh that it were poſſible to eſtabliſh republics of this kind among mankind. But the diſpoſitions of men have little affinity to thoſe of the beavers.

The hampſter, or German marmot, and ſome other quadrupeds of this kind, live in ſociety, and aſſiſt each other in digging and rendering commodious their ſubterraneous habitations. The operations of the marmots have already been deſcribed; and the nature of their ſociety, as they continue during the winter in a torpid ſtate, is either leſs known, or does not excite ſo much admiration as that of the beavers.

Pairing birds, in ſome meaſure, may be conſidered as forming proper ſocieties; becauſe, in general, the males and females mutually aſſiſt each other in building neſts and feeding their young. But this ſociety, except in the eagle tribes, commonly continues no longer than their mutual offspring are fully able to provide for themſelves. None of the feathered tribes, as far as we know, unite in bodies, in order to carry on any operation common to the whole.

Neither do we learn from hiſtory that fiſhes ever aſſociate for the purpoſe of executing any common operation. Many of them, as herrings, ſalmons, &c. aſſemble in multitudes at particular ſeaſons of the year; but this aſſociation, to which they are impelled by inſtinct, has no common object; for each individual is ſtimulated to act in this manner by its own motives, and no general effect is produced by mutual exertions.

In proper ſocieties, each individual not only attends to his own preſervation and welfare, but all the members co-operate in certain laborious offices which produce many common advantages that could not otherwiſe be procured. In ſome ſocieties, the general principle of aſſociation and of mutual labour is purely inſtinctive, though, in many caſes, individuals learn, by obſervation and experience, to modify or accommodate this general principle according to particular accidents or circumſtances; ſome examples of which have already been given in the chapter upon inſtinct.

The inſect tribes furniſh many inſtances of proper ſocieties. The honey-bees not only labour in common with aſtoniſhing aſſiduity and art, but their whole attention and affections ſeem to centre in the perſon of the queen or ſovereign of the hive. She is the baſis of their aſſociation and of all their operations. When ſhe dies by any accident, the whole community are inſtantly in diſorder. All their labours ceaſe. No new cells are conſtructed. Neither honey nor wax are collected. Nothing but perfect anarchy prevails, till a new queen or female is obtained. The government or ſociety of bees is more of a monarchical than of a republican nature. The whole members of the ſtate ſeem to reſpect and to be directed by a ſingle female. This fact affords a ſtrong inſtance of the force and wiſdom of Nature. The female alone is the mother of the whole hive, however numerous. Without her the ſpecies could not be continued. Nature, therefore, has endowed the reſt of the hive with a wonderful affection to their common parent. For the reception of her eggs Nature impels them to conſtruct cells, and to lay up ſtores of proviſions for winter ſubſiſtence. Theſe operations proceed from pure inſtinctive impulſes. But every inſtinct neceſſarily ſuppoſes a degree of intellect, a ſubſtratum to be acted upon, otherwiſe no impulſe could be felt, and, of courſe, no action nor mark of intelligence could poſſibly be produced.

That the intelligence, the government, and the ſagacity of bees, have been frequently exaggerated, and as frequently miſunderſtood, no real philoſopher, or natural hiſtorian, will pretend to deny. But the late ingenious Count de Buffon, through the whole of his great work, betrays the ſtrongeſt inclination to deny that brutes, even thoſe which are eſteemed to be the moſt ſagacious, as the dog, the elephant, &c. not to mention the inferior tribes, as birds, fiſhes, and inſects, are endowed with the ſmalleſt portion of mind or intellect, but that all their movements, their expreſſions, their deſires, their arts, are ſolely the reſults of mechanical impulſes. The Count is peculiarly ſevere in his declamations againſt the ſagacity of the honey-bees, and the celebrators of their oeconomy and manners. ‘ The genius of ſolitary bees,’ he remarks, ‘ is vaſtly inferior to that of the gregarious ſpecies; and ‘ the talents of thoſe which aſſociate in ſmall troops are leſs conſpi‘ cuous than of thoſe that aſſemble in numerous bodies. Is not this ‘ alone ſufficient to convince us, that the *ſeeming genius* of bees is ‘ nothing but a reſult of *pure mechaniſm*, a combination of move‘ ments proportioned to numbers, an effect which appears to be com‘ plicated, only becauſe it depends on thouſands of individuals? It ‘ muſt, therefore, be admitted, that bees, taken ſeparately, have leſs ‘ genius than the dog, the monkey, and moſt other animals: It will ‘ likewiſe be admitted, that they have leſs docility, leſs attachment, ‘ and leſs ſentiment; and that they poſſeſs fewer qualities relative to ‘ thoſe of the human ſpecies. Hence we ought to acknowledge, ‘ that their apparent intelligence proceeds ſolely from the *multitude ‘ united*. This union, however, preſuppoſes not intellectual powers; ‘ for they unite not from moral views: They find themſelves to‘ gether without their conſent. This ſociety, therefore, is a phyſical 'aſſemblage ordained by Nature, and has no dependence on know-'ledge or reaſoning. The mother bee produces at one time, and in 'the ſame place, ten thouſand individuals, which, though they were 'much more ſtupid than I have ſuppoſed them, would be obliged, 'ſolely for the preſervation of their exiſtence, to arrange themſelves 'into ſome order. As they all act againſt each other with equal 'forces, ſuppoſing their firſt movements to produce pain, they would 'ſoon learn to diminiſh this pain, or, in other words, to afford mu-'tual aſſiſtance: They, of courſe, would exhibit an air of intelli-'gence, and of concurring in the accompliſhment of the ſame end. 'A ſuperficial obſerver would inſtantly aſcribe to them views and 'talents which they by no means poſſeſs: He would explain every 'action: Every operation would have its particular motive, and pro-'digies of reaſon would ariſe without number; for ten thouſand in-'dividuals produced at one time, and obliged to live together, muſt 'all act in the very ſame manner; and, if endowed with feeling, 'they muſt acquire the ſame habits, aſſume that arrangement which 'is the leaſt painful, or the moſt eaſy to themſelves, labour in their 'hive, *return* after leaving it, &c. Hence the *origin* of the many 'wonderful talents aſcribed to bees, ſuch as their architecture, their 'geometry, their order, their foreſight, their patriotiſm, and, in a 'word, their republic, the whole of which, as I have *proved*, has no 'exiſtence but in the imagination of the obſerver *.'

That this mode of reaſoning ſhould have been ſeriouſly adopted by ſo great a literary character as that of the Count de Buffon, is truly aſtoniſhing. The ſubſtance of the argument is, that ten thouſand bees, or other gregarious inſects, when brought into exiſtence at the ſame time, and in the ſame place, muſt neceſſarily, by the inconvenience or pain ariſing from mutual preſſure, aſſume an arrangement, and conſtruct commodious and artful habitations for the whole community. I hate polemical argumentation; and philoſophical abſurdities are the moſt difficult to refute. If ten thouſand butterflies, or any other flies, whoſe inſtinctive or mental powers differed from thoſe of the bee, ſhould be brought forth at the ſame time, and in the ſame place, which might be eaſily effected by collecting their chryſalids, Would theſe animals, from the inconveniencies or pain they might ſuffer by being crouded together, aſſume a proper arrangement, and build habitations ſuited to their mutual comfort and preſervation? No. If not allowed to eſcape from their preſent ſituation, they would ſuffocate each other; and, if any of them were permitted to get out of their priſon, inſtead of returning, like the bees, they would avoid it with as much horror as a perſon who had made his eſcape from the Black Hole of Calcutta. No declamatory reaſoning, however ſpecious, will ever change the nature of truth. Without ſome portion of intellect, or what is ſynonimous, of mental powers, How ſhould the different kinds of bees in the ſame hive be induced to perform ſo many different operations? While ſome are buſily employed at home in the conſtruction of cells, others are equally induſtrious in the fields collecting materials for carrying on the work. They are no ſooner relieved from their load by their companions and fellow-labourers in the hive, than they again repair to the fields, and, with perſevering induſtry, fly from flower to flower till they have amaſſed another load of materials, which they immediately tranſport to the hive. In this laborious office they perſiſt for many hours every day when the weather permits. Will any man pretend to aſſert, that theſe, and many ſimilar operations performed by bees, are the reſults of mechanical impulſes *? Are bees, when collecting honey, and the farina of flowers, at great diſtances from

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* Tranſlation, vol. 3. page 285.

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* For ſeveral curious operations of bees, which it will be difficult to reconcile with any principles of mechaniſm, the reader may conſult page 336, &c.

from the hive, compelled, by the mechanical preſſure of multitudes, to aſſume a certain arrangement, and all of them to act in the ſame manner? Can any animal be poſſeſſed of more liberty, or be more free from mechanical reſtraint, than a bee while roaming at large in the fields? Beſides, What ſhould force a bee, while wallowing in luxury, to return ſo repeatedly to the hive with no other view than to feed its companions, or to furniſh them with materials for their work? Here every idea of mechanical impulſe is utterly excluded. That bees, as well as other animals, are actuated by motives, or impulſes, it is willingly allowed. But theſe are not mechanical impulſes. They are the wiſe and irreſiſtible impulſes of Nature upon their minds. If bees did not aſſociate, and mutually aſſiſt one another in their various operations, the ſpecies would ſoon be annihilated. Not one of them, it is probable, would ſurvive the firſt winter. But Nature, ever ſolicitous for the preſervation of her productions, has endowed their minds with an aſſociating principle, and with inſtincts which ſtimulate them to perform all thoſe wonderful operations that are neceſſary for the exiſtence of individuals, and the continuation of the ſpecies.

What are called the *common* caterpillars afford an inſtance of proper aſſociation. About the middle of ſummer, a butterfly depoſits from three to four hundred eggs on the leaf of a tree, from each of which, in a few days, a young caterpillar proceeds. They are no ſooner hatched than they begin to form a common habitation. They ſpin ſilken threads, which they attach to one edge of the leaf, and extend them to the other. By this operation they make the two edges of the leaf approach each other, and form a cavity reſembling a hammock. In a ſhort time, the concave leaf is completely roofed with a covering of ſilk. Under this tent the animals live together in mutual friendſhip and harmony. When not diſpoſed to eat or to ſpin, they retire to their tent. It requires ſeveral of theſe habitations to contain the whole. According as the animals increaſe in ſize, the number of their tents is augmented. But theſe are only temporary and partial lodgements, conſtructed for mutual conveniency, till the caterpillars are in a condition to build one more ſpacious, and which will be ſufficient to contain the whole. After gnawing one half of the ſubſtance of ſuch leaves as happen to be near the end of ſome twig or ſmall branch, they begin their great work. In conſtructing this new edifice or neſt, the caterpillars encruſt a conſiderable part of the twig with white ſilk. In the ſame manner, they cover two or three of ſuch leaves as are neareſt to the termination of the twig. They then ſpin ſilken coverings of greater dimenſions, in which they incloſe the two or three leaves together with the twig. The neſt is now ſo ſpacious that it is able to contain the whole community, every individual of which is employed in the common labour. Theſe neſts are too frequently ſeen, in autumn, upon the fruit-trees of our gardens. They are ſtill more expoſed to obſervation in winter, when the leaves, which formerly concealed many of them, are fallen. They conſiſt of large bundles of white ſilk and withered leaves, without any regular or conſtant form. Some of them are flat, and others roundiſh; but none of them are deſtitute of angles. By different plain coverings extended from the oppoſite ſides of the leaves and of the twig, the internal part of the neſt is divided into a number of different apartments. To each of theſe apartments, which ſeem to be very irregular, there are paſſages by which the caterpillars can either go out in queſt of food, or retire in the evening, or during rainy weather. The ſilken coverings, by repeated layers, become at laſt ſo thick and ſtrong, that they reſiſt all the attacks of the wind, and all the injuries of the air, during eight or nine months. About the beginning of October, or when the froſt firſt commences, the whole community ſhut themſelves up in the neſt. During the winter they remain immoveable, and ſeemingly dead. But, when expoſed to heat, they ſoon diſcover ſymptoms of life, and begin to creep. In this country, they ſeldom go out of the neſt till the middle or end of April. When they ſhut themſelves up for the winter, they are very ſmall; but, after they have fed for ſome days in ſpring upon the young and tender leaves, they find the neſt itſelf, and all the entrances to it, too ſmall for the increaſed ſize of their bodies. To remedy this inconveniency, theſe diſguſting reptiles know how to enlarge both the neſt and its paſſages by additional operations accommodated to their preſent ſtate. Into theſe new lodgings they retire when they want to repoſe, to ſcreen themſelves from the injuries of the weather, or to caſt their ſkins. In fine, after caſting their ſkins ſeveral times, the time of their diſperſion arrives. From the beginning to near the end of June, they lead a ſolitary life. Their ſocial diſpoſition is no longer felt. Each of them ſpins a pod of coarſe browniſh ſilk. In a few days they are changed into chryſalids; and, in eighteen or twenty days more, they are transformed into butterflies.

Caterpillars of another ſpecies, which Reaumur diſtinguiſhes by the appellation of the *proceſſionary caterpillar*, live in ſociety till their transformation into flies. Theſe caterpillars are of the hairy kind, and are of a reddiſh colour. They inhabit the oak, and feed upon its leaves. When very young, they have no fixed or general habitation. But, after they have acquired about one half of their natural ſize, they aſſemble together, and conſtruct a neſt ſufficient to accommodate the whole. The neſts of theſe caterpillars are attached to the trunks of the oak, and are ſituated ſometimes near the earth, and ſometimes ſeven or eight feet above its ſurface. They conſiſt of different ſtrata, or layers, of ſilk, which are ſpun by the united labour of the whole community. Their figure is neither ſtriking nor uniform. On the part of the oak to which they are fixed they form a protuberance ſimilar to thoſe knots which are ſeen upon trees. This protuberance ſometimes reſembles a ſegment of a circle, and ſometimes it is three or four times longer than it is broad. Some of theſe neſts are from eighteen to twenty inches long, and from five to ſix inches wide. About the middle of their convexity, they often riſe more than four inches above the ſurface of the tree. Between the trunk of the tree and the layers of ſilk a ſingle hole is left, to allow the animals to go out in queſt of food, and to retire into the neſt after they are ſatiated. Notwithſtanding the great bulk of theſe neſts, and though there are often three or four of them upon the ſame tree, and never elevated above the height of diſtinct viſion, they are not eaſily perceived; for the ſilk of which they are compoſed is cinereous, and reſembles, in colour, thoſe moſſes with which the trunk of the oak is generally covered.

The inhabitants of a neſt, which are numerous, march out, about the ſetting of the ſun, to forage, under the conduct of a chief or leader, all whoſe movements they uniformly follow. The order they obſerve is ſingular. The firſt rank conſiſts of ſingle animals, the ſecond of two, the third of three, the fourth of four, and ſometimes more. In this manner they proceed in queſt of food with all the regularity of diſciplined troops. The chief or leader has no marks of pre-eminence; for any individual that happens firſt to iſſue from the neſt, from that circumſtance alone, becomes the leader of an expedition. After making a full repaſt upon the neighbouring leaves, they return to the neſt in the ſame regular order; and this practice they continue during the whole period of their exiſtence in the caterpillar ſtate. It was from this ſtrange regularity of movement that Reaumur, with much propriety, denominated theſe animals *proceſſionary* caterpillars. When arrived at maturity, each individual ſpins a ſilken pod, is converted into a chryſalis, and afterwards aſſumes the form of a butterfly. This laſt tranſformation breaks all the bonds of their former aſſociation, and the female flies depoſit their eggs, which, when hatched, produce new colonies, who exhibit the ſame oeconomy and manners.

There are ſeveral ſpecies of caterpillars who are real republicans, and whoſe diſcipline, manners, and genius, are equally diverſified as thoſe of the inhabitants of different nations and climates. Some, like particular ſavages, conſtruct a kind of hammocks, in which they take their victuals, repoſe, and ſpend their lives till the period of their transformation. Others, like the Arabs and Tartars, conſtruct and live in ſilken tents, and, after conſuming the neighbouring herbage, they leave their former habitations, and encamp on freſh paſture. Under theſe tents they are not only protected from the injuries of the weather, but they repoſe in them when ſick, or in a ſtate of inactivity. They go out of their tents at particular times in queſt of food, and often to conſiderable diſtances; but they never loſe their way back. It is not by ſight that they are directed with ſo much certainty to their abodes. Nature has furniſhed them with another guide for regaining their habitations. We pave our ſtreets with ſtones; but the caterpillars cover all their roads with ſilken threads. Theſe threads make white tracks, which are often more than a ſixth of an inch wide. It is by following theſe ſilken tracks, however complicated, that the caterpillars never miſs their neſts. If the road is broke by a man's finger drawn along it, or by any other accident, the caterpillars are greatly embarraſſed. They ſtop ſuddenly at the interrupted ſpace, and exhibit every mark of fear and of diffidence. Here the march ſtops, till an individual, more bold or more impatient than his companions, traverſes the gap. In his paſſage, he leaves behind him a thread of ſilk, which ſerves as a bridge or conductor to the next that follows. By the progreſſion of numbers, each of which ſpins a thread, the breach is ſoon repaired. We cannot ſuppoſe that theſe ſtupid animals cover their roads to prevent their wandering. But they never wander, becauſe their roads are covered with ſilk. In this, as well as in many other inſtances, Nature obliges animals to embrace the moſt effectual means of ſelf-preſervation, and even of conveniency, without their perceiving the utility of their own operations. The caterpillars, whoſe manners we have been deſcribing, ſpin almoſt continually, becauſe they are continually obliged to evacuate a ſilky matter, ſecreted from their food by veſſels deſtined for that purpoſe, and included in their inteſtines. In obeying this call of Nature, they effectually ſecure their retreat to their neſts, and perhaps their exiſtence. It may be ſaid, that caterpillars aſſociate for no other reaſon but becauſe they are all produced at the ſame time from eggs depoſited near each other. But many other ſpecies of caterpillars, who are brought to life in the very ſame circumſtances, never aſſociate or act in concert in the performance of any mutual labour. The ſilk-worms afford a familiar example.* It is true, they ſpontaneouſly remain aſſembled in the ſame place, which is of great advantage to manufacture. But the individuals of other ſpecies diſperſe immediately after birth, and never re-unite. Spiders, when newly hatched, begin with ſpinning a web in common; but they ſoon terminate this aſſociation by devouring one another.

As caterpillars do not engender till they arrive at the butterfly ſtate, their aſſociations have no reſpect to the rearing or education of young. Self-preſervation and individual conveniency are the only bonds of their union. A perfect equality reigns among them, without any diſtinction of ſex, or even of ſize. Each takes his ſhare of the common labour; and the whole ſociety, which conſtitutes but one family, is the genuine iſſue of the ſame mother.

The aſſociation and oeconomy of the common ants merit ſome attention. With wonderful induſtry and activity they collect materials for the conſtruction of their neſt. They unite in numbers, and aſſiſt each other in excavating the earth, and in tranſporting to their habitation bits of ſtraw, ſmall pieces of wood, and other ſubſtances of a ſimilar kind, which they employ in lining and ſupporting their ſubterraneous galleries. The form of their neſt or hill is ſomewhat conical, and, of courſe, the water, when it rains, runs eaſily off, without penetrating their abode. Under this hill there are many galleries or paſſages which communicate with each other, and reſemble the ſtreets of a ſmall city.

The ants not only aſſociate for the purpoſe of conſtructing a common habitation, but for cheriſhing and protecting their offspring. Every perſon muſt have often obſerved, when part of a neſt is ſuddenly expoſed, their extreme ſolicitude for the preſervation of their chryſalids or nymphs, which often exceed the ſize of the animals themſelves. With amazing dexterity and quickneſs the ants tranſport their nymphs into the ſubterraneous galleries of the neſt, and place them beyond the reach of any common danger. The courage and fortitude with which they defend their young is no leſs aſtoniſhing. The body of an ant was cut through the middle, and, after ſuffering this cruel treatment, ſo ſtrong was its parental affection, with its head, and one half of the body, it carried off eight or ten nymphs. They go to great diſtances in ſearch of proviſions. Their roads, which are often winding and involved, all terminate in the neſt.

The wiſdom and foreſight of the ants have been celebrated from the remoteſt antiquity. It has been aſſerted and believed, for near three thouſand years, that they lay up magazines of proviſions for the winter, and that they even cut off the germ of the grain to prevent it from ſhooting. But the ancients were never famed for accurate reſearches into the nature and operations of inſects. Theſe ſuppoſed magazines could be of no uſe to the ants; for, like the marmots and dormice, they ſleep during the winter. A very moderate degree of cold is ſufficient to render them torpid. In fact, it is now well known that they amaſs no magazines of proviſions. The grains which, with ſo much induſtry and labour, they carry to their neſt, are not intended to be food to the animals, but, like the bits of ſtraw and wood, are employed as materials in the conſtruction of their habitation.

2. *Improper Societies.*—Many animals are gregarious, though they unite not with a view to any joint operation, ſuch as conſtructing common habitations, or mutually and indiſcriminately nouriſhing and protecting the offspring produced by the whole ſociety. But, even among animals of this deſcription, there are motives or bonds of aſſociation, and, in many inſtances, they mutually aſſiſt and defend each other from hoſtile aſſaults.

The ox is a gregarious animal. When a herd of oxen are paſturing in a meadow, if a wolf makes his appearance, they inſtantly form themſelves in battle array, and preſent their united horns to the enemy. This warlike diſpoſition often intimidates the wolf, and obliges him to retire.

In winter, the hinds and young ſtags aſſociate, and form herds, which are always more numerous in proportion to the ſeverity of the weather. One bond of their ſociety ſeems to be the advantage of mutual warmth derived from each other's bodies. In ſpring they diſperſe, and the hinds conceal themſelves in the foreſts, where they bring forth their young. The young ſtags, however, continue together; they love to browſe in company; and neceſſity alone forces them to ſeparate.

The Count de Buffon repreſents ſheep as ſtupid creatures, which are incapable of defending themſelves againſt the attacks of any rapacious animal. He maintains that the race muſt long ago have been extinguiſhed, if man had not taken them under his immediate protection. But Nature has furniſhed every ſpecies of animated beings with weapons and arts of defence which are ſufficient for individual preſervation as well as the continuation of the kind. Sheep are endowed with a ſtrong aſſociating principle. When threatened with an attack, like ſoldiers, they form a line of battle, and boldly face the enemy. In a natural ſtate, the rams conſtitute one half of the flock. They join together and form the front. When prepared in this manner for repelling an aſſault, no lion or tiger can reſiſt their united impetuoſity and force.

A family of hogs, when in a ſtate of natural liberty, never ſeparate till the young have acquired ſtrength ſufficient to repel the wolf. When a wolf threatens an attack, the whole family unite their forces, and bravely defend each other.

The wild dogs of Africa hunt in packs, and carry on a perpetual war againſt other rapacious animals. The jackals of Aſia and Africa likewiſe hunt in packs. But, though animals of this kind mutually aſſiſt each other in killing prey, individual advantage is the chief, if not the only bond of this temporary union.

Another kind of ſociety is obſervable among domeſtic animals. Horſes and oxen, when deprived of companions of their own ſpecies, aſſociate, and diſcover a viſible attachment. A dog and an ox, or a dog and a cow, when placed in certain circumſtances, though the ſpecies are remote, and even hoſtile, acquire a ſtrong affection for each other. The ſame kind of aſſociation takes place between dogs and cats, between cats and birds, &c. If domeſtic animals had a ſtrong averſion to one another, man could not derive ſo many advantages from them. Horſes, oxen, ſheep, &c. by browſing promiſcuouſly together, augment and meliorate the common paſture. By living under the ſame roof, and feeding in common, this aſſociating principle is ſtrengthened and modified by habit, which often commences immediately after birth. A ſingle horſe confined in an incloſure, diſcovers every mark of uneaſineſs. He becomes reſtleſs, neglects his food, and breaks through every fence in order to join his companions in a neighbouring field. Oxen and cows will not fatten in the fineſt paſture, if they are deprived of ſociety.

From the facts and remarks contained in this chapter, it ſeems to be evident, that the principle of aſſociation in man, as well as in many other animals, is purely inſtinctive; and that this principle may be ſtrengthened and modified by the numberleſs advantages derived from it, by imitation, by habit, and by many other circumſtances.

CHAPTER XVII.

Of the Docility of Animals.

OF all animals capable of culture, man is the moſt ductile. By inſtruction, imitation, and habit, his mind may be moulded into any form. It may be exalted by ſcience and art to a degree of knowledge, of which the vulgar and uninformed have not the moſt diſtant conception. The reverſe is melancholy. When the human mind is left to its own operations, and deprived of almoſt every opportunity of ſocial information, it ſinks ſo low, that it is nearly rivaled by the moſt ſagacious brutes. The natural ſuperiority of man over the other animals, as formerly remarked, is a neceſſary reſult of the great number of inſtincts with which his mind is endowed. Theſe inſtincts are gradually unfolded, and produce, after a mature age, reaſon, abſtraction, invention, ſcience. To confirm this truth, it would be fruitleſs to have recourſe to metaphyſical arguments, which generally miſlead and bewilder human reaſon. A diligent attention to the actual operations of Nature is ſufficient to convince any mind that is not warped and deceived by popular prejudice, the fetters of authorities, as they are called, whether ancient or modern, or by the vanity of ſupporting preconceived opinions and favourite theories. Let any man reflect on the progreſs of children from birth to manhood. At firſt, their inſtincts are limited to obſcure ſenſations, and to the performance of a few corporeal actions, to which they are prompted, or rather compelled, by certain ſtimulating impulſes unneceſſary to be mentioned. In a few months, their ſenſations are perceived to be more diſtinct, their bodily actions are better directed, new inſtincts are unfolded, and they aſſume a greater appearance of rationality and of mental capacity. When ſtill farther advanced, and after they have acquired ſome uſe of language, and ſome knowledge of natural objects, they begin to reaſon; but their reaſonings are feeble, and often prepoſterous. In this manner they uniformly proceed in improvement till they are actuated by the laſt inſtinct, at or near the age of puberty. After this period, they reaſon with ſome degree of perſpicuity and juſtneſs. But, though their whole inſtincts are now unfolded and in action, every power of their minds requires, previous to its utmoſt exertions, to be agitated and poliſhed by an examination of a thouſand natural and artificial objects, by the experience and obſervations of thoſe with whom they aſſociate, by public or private inſtruction, by ſtudying the writings of their predeceſſors and contemporaries, and by their own reflections, till they arrive at the age of thirty-five. Previous to that period, much learning may have been acquired, much genius may have been exerted; but, before that time of life, judgment, abſtraction, and the reaſoning faculty, are not fully matured. This progreſs is the genuine operation of Nature, and the gradual ſource of human ſagacity and mental powers. The ſame progreſs is to be obſerved in the powers of the body. It arrives, indeed, ſooner at perfection than the mind. But, if the progreſs of the mind greatly preceded that of the body, what a miſerable and aukward figure would human beings, at an early period of their exiſtence, exhibit? Active and vigorous minds, ſtimulated to command what the organs of their bodies were unable to obey, would produce peeviſhneſs, anger, regret, and every diſtreſſing paſſion.

The bodies of men, though not ſo ductile as their minds, are capable, when properly managed by early culture, of wonderful exertions. Men, accuſtomed to live in poliſhed ſocieties, have little or no idea of the activity, the courage; the patience, and the perſevering induſtry of ſavages, when ſimply occupied in hunting wild animals for food to themſelves and their families. The hunger, the fatigue, the hardſhips, which they not only endure, but deſpiſe with fortitude, would amaze and terrify the imagination of any civilized European.

Beſide man, many other animals are capable of being inſtructed. The ape-kind, and eſpecially the larger ſpecies of them, imitate the actions of men without any inſtruction. This imitation they are enabled to perform with the greater exactneſs, on account of their ſtructure. The orang-outang, a native of the ſouthern regions of Africa and India, is as tall and as ſtrong as a man. He has no tail. His face is flat. His arms, hands, toes, and nails, are perfectly ſimilar to ours. He walks conſtantly on end; and the features of his viſage make a near approach to thoſe of the human countenance. He has a beard on his chin, and no more hair on his body than men have when in a ſtate of nature. He knows how to bear arms, to attack his enemies with ſtones, and to defend himſelf with a club. Of all the apes, the orang-outang, or *wild man*, as he is called by the Indians, has the greateſt reſemblance to man both in the ſtructure of his body and in his manners. There are two ſuppoſed ſpecies of orang-outang, a larger and a ſmaller. The latter has been ſeveral times brought to Europe, and accurate deſcriptions have been given both of his external and internal parts. But, with regard to the larger kind, who is ſaid to exceed the ordinary ſtature of man, we have nothing to rely on but the relations of travellers. Bontius, who was chief phyſician in Batavia, affirms expreſsly, that he ſaw, with admiration, ſeveral individuals of this ſpecies walking on their two feet. Among others, he remarked a female, who ſeemed to have a ſenſe of modeſty, who covered her face with her hands when men approached her with whom ſhe was unacquainted, who wept, groaned, and ſeemed to want nothing of humanity but the faculty of ſpeech *. Many other ſurpriſing actions performed by this animal are recorded by different voyagers, which it is unneceſſary to repeat, eſpecially as we have a ſufficient number of facts atteſted by unequivocal evidence. The Count de Buffon, with much probability, conſiders what are called the large and ſmall orang-outangs to be the ſame ſpecies of animals; for thoſe hitherto brought to Europe were very young, and had not acquired one half of their ſtature.

'The orang-outang,' ſays Buffon, 'which I ſaw, walked always 'on two feet, even when carrying things of conſiderable weight. 'His air was melancholy, his movements meaſured, his diſpoſitions 'gentle, and very different from thoſe of other apes. He had neither the impatience of the Barbary ape, the maliciouſneſs of the 'baboon, nor the extravagance of the monkeys. It may be alledged 'that he had the benefit of inſtruction; but the apes, which I ſhall 'compare with him, were educated in the ſame manner. Signs and 'words were alone ſufficient to make our orang-outang act: But 'the baboon required a cudgel, and the other apes a whip; for none 'of them would obey without blows. I have ſeen this animal preſent his hand to conduct the people who came to viſit him, and 'walk as gravely along with them as if he had formed a part of the 'company. I have ſeen him ſit down at table, unfold his towel, 'wipe his lips, uſe a ſpoon or a fork to carry the victuals to his 'mouth, pour his liquor into a glaſs, and make it touch that of the 'perſon who drank along with him. When invited to drink tea, 'he

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* Jac. Bont. Hiſt. Nat. Ind. cap. 32.

'he brought a cup and a ſaucer, placed them on the table, put in 'ſugar, poured out the tea, and allowed it to cool before he drank 'it. All theſe actions he performed without any other inſtigation 'than the ſigns or verbal orders of his maſter, and often of his own 'accord. He did no injury to any perſon: He even approached 'company with circumſpection, and preſented himſelf as if he wanted to be careſſed. He was very fond of dainties, which every 'body gave him: And, as his breaſt was diſeaſed, and he was afflicted with a teazing cough, this quantity of ſweatmeats undoubtedly contributed to ſhorten his life. He lived one ſummer 'in Paris, and died in London the following winter. He eat almoſt 'every thing; but preferred ripe and dried fruits to all other kinds 'of food. He drank a little wine; but ſpontaneouſly left it for 'milk, tea, or other mild liquors [*].'

M. de la Broſſe purchaſed two orang-outangs from a Negro, whoſe age exceeded not twelve months. 'Theſe animals,' he remarks, 'have the inſtinct of ſitting at table like men. They eat every 'kind of food without diſtinction. They uſe a knife, a fork, or a 'ſpoon, to cut or lay hold of what is put upon their plate. They 'drink wine and other liquors. We carried them aboard. At table, 'when they wanted any thing, they made themſelves be underſtood 'by the cabin-boy: And, when the boy refuſed to give them what 'they demanded, they ſometimes became enraged, ſeized him by 'the arm, bit, and threw him down.—The male was ſeized with 'ſickneſs in the road. He made himſelf be attended as a human 'being. He was even twice bled in the right arm: And, whenever 'he found himſelf afterwards in the ſame condition, he held out 'his arm to be bled, as if he knew that he had formerly received 'benefit from that operation.'

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[*] Buffon, vol. 8. page 86. tranſ.

We are informed by Francis Pyrard, 'that, in the province of 'Sierra-Leona, there is a ſpecies of animals called *baris*, (the orang-'outang), who are ſtrong and well limbed, and ſo induſtrious, 'that, when properly trained and fed, they work like ſervants; that 'they generally walk on the two hind-feet; that they pound any 'ſubſtances in a mortar; that they go to bring water from the river 'in ſmall pitchers, which they carry full on their heads. But, 'when they arrive at the door, if the pitchers are not ſoon taken 'off, they allow them to fall; and, when they perceive the pitcher 'overturned and broken, they weep and lament *.' With regard to the education of theſe animals, the teſtimony of Schoutton correſponds with that of Pyrard. 'They are taken,' ſays he, 'with ſnares, 'taught to walk on their hind-feet, and to uſe their fore-feet as 'hands in performing different operations, as rinſing glaſſes, carry-'ing drink round the company, turning a ſpit,' &c. †. Guat informs us, that he 'ſaw at Java a very extraordinary ape. It was a 'female. She was very tall, and often walked erect on her hind-'feet. On theſe occaſions, ſhe concealed with her hands the parts 'which diſtinguiſh the ſex.—She made her bed very neatly every 'day, lay upon her ſide, and covered herſelf with the bed-clothes.—'When her head ached, ſhe bound it up with her handkerchief; 'and it was amuſing to ſee her thus hooded in bed. I could relate 'many other little articles which appeared to be extremely ſingular. 'But I admired them not ſo much as the multitude; becauſe, as I 'knew the deſign of bringing her to Europe to be exhibited as a 'ſhew, I was inclined to think that ſhe had been *taught* many of 'theſe monkey tricks, which the people conſidered as being natural 'to the animal. She died in our ſhip, about the latitude of the

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* Voyages de François Pyrard, tom. 2. pag. 331.

† Voyages de Schoutton aux Indes Orientales.

‘ Cape of Good Hope. The figure of this ape had a very great re-
‘ ſemblance to that of man *.’

We have now enumerated the principal facts regarding this extraordinary animal, which have been related by voyagers of credit, and by thoſe who have ſeen and examined him in Europe; and ſhall only remark, that, notwithſtanding the great ſimilarity of his ſtructure and organs to thoſe of the human ſpecies, his genius and talents ſeem to be very limited. The form of his body enables him to imitate every human action. But, though he has the organs of ſpeech, he is deſtitute of articulate language. If, however, he were domeſticated, and proper pains beſtowed for inſtructing him, he might unqueſtionably be taught to articulate. But, ſuppoſing this point to be obtained, if he remained incapable of reflection, if he was unable to comprehend the meaning of words, or to diſcover by his expreſſions a degree of intellect greatly ſuperior to that of the brute creation, which I imagine would be the caſe, he could never, as ſome authors have held forth, be exalted to the diſtinguiſhed rank of human beings.

Of all quadrupeds, of whoſe hiſtory and manners we have any proper knowledge, the elephant is moſt remarkable both for docility and underſtanding. Though his ſize is enormous, and his members rude and diſproportioned, which give him, at firſt ſight, the aſpect of dullneſs and ſtupidity, his genius is great, and his ſagacious manners, and his ſedate and collected deportment, are almoſt incredible. He is the largeſt and ſtrongeſt of all terreſtrial animals. Though naturally brave, his diſpoſitions are mild and peaceable. He is an aſſociating animal, and ſeldom appears alone in the foreſts. When in danger, or when they undertake a depredatory expedition into

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* Voyages de Fran. le Guat, tom. 2. pag. 96.

cultivated fields, the elephants aſſemble in troops. The oldeſt takes the lead; the next in ſeniority brings up the rear; and the young and the feeble occupy the center. In the foreſts and ſolitudes they move with leſs precaution; but never ſeparate ſo far aſunder as to render them incapable of affording each other mutual aſſiſtance when danger approaches. A troop of elephants conſtitutes a moſt formidable band. Wherever they march, the foreſt ſeems to fall before them. They bear down the branches upon which they feed; and, if they enter an incloſure, they ſoon deſtroy all the labours of the huſbandman. Their invaſions are the more tremendous, as there is hardly any means of repelling them; for, to attack a troop, when thus united, would require a little army. It is only when one or two elephants happen to linger behind the reſt, that the hunters dare exert their art and ingenuity in making an attack; for any attempt to diſturb the troop would certainly prove fatal to the aſſailants. When an inſult is offered, the elephants inſtantly move forward againſt the offender, toſs him in the air with their tuſks, and afterwards trample him to pieces under their feet, or rather pillars of fleſh and bone. Let not the character of this noble and majeſtic animal, however, be miſrepreſented. With force and dignity he reſents every affront; but, when not diſturbed by petulance or actual injury, he never ſhows an hoſtile intention either againſt man or any other animal. Elephants live entirely on vegetables, and have no thirſt for blood. Such is their ſocial and generous diſpoſition, that, when an individual chances to meet with a luxurious ſpot of paſture, he immediately calls to his companions, and invites them to partake of his good fortune.

The elephant poſſeſſes all the ſenſes in perfection: But, in the ſenſe of touching, he excells all the brute creation. His trunk is the chief inſtrument of this ſenſe. In an elephant of fourteen feet high, the trunk is about eight feet long, and five feet and an half in circumference at the baſe. It is a large fleſhy tube, divided through its whole extent by a ſeptum or partition. It is capable of motion in every direction. The animal can ſhorten or lengthen it at pleaſure. It anſwers every purpoſe of a hand; for it graſps large objects with great force, and its extremity can lay hold of a ſixpence, or even of a pin. The trunk of the elephant affords him the ſame means of addreſs as the ape. It ſerves the purpoſes of an arm and a hand. By this inſtrument, the elephant conveys large or ſmall bodies to his mouth, places them on his back, embraces them faſt, or throws them forcibly to a diſtance. In a ſtate of nature and perfect freedom, the diſpoſitions of the elephant are neither ſanguinary nor ferocious. They are gentle creatures, and never exert their ſtrength, or employ their weapons, but in defending themſelves or protecting their companions. Even when deprived of the inſtruction of men, they poſſeſs the ſagacity of the beaver, the addreſs of the ape, and the acuteneſs of the dog. To theſe mental talents are added the advantages of amazing bodily ſtrength, and the experience and knowledge he acquires by living at leaſt two centuries. With his trunk he tears up trees. By a puſh of his body he makes a breach in a wall. To this prodigious ſtrength he adds courage, prudence, and coolneſs of deportment. As he never makes an attack but when he receives an injury, he is univerſally beloved; and all animals reſpect, becauſe none have any reaſon to fear him. In all ages, men have entertained a veneration for this moſt magnificent and ſagacious of terreſtrial creatures. The ancients regarded him as a miracle of Nature, and he is, in reality, one of her greateſt efforts. But they have greatly exaggerated his faculties. Without heſitation, they have aſcribed to him high intellectual powers and moral virtues. Pliny, Ælian, Plutarch, and other authors of a more modern date, have beſtowed on the elephant not only rational manners, but an innate religion, a kind of daily adoration of the ſun and moon, the uſe of ablution before worſhip, a ſpirit of divination, piety toward heaven and their fellow creatures, whom they aſſiſt at the approach of death, and, after their deceaſe, bedew them with tears, and cover their bodies with earth.

When tamed and inſtructed by man, the elephant is ſoon rendered the mildeſt and moſt obedient of all domeſtic animals. He loves his keeper, careſſes him, and anticipates his commands. He learns to comprehend ſigns, and even to underſtand the expreſſion of ſounds. He diſtinguiſhes the tones of command, of anger, and of approbation, and regulates his actions by his perceptions. The voice of his maſter he never miſtakes. His orders are executed with alacrity, but without any degree of precipitation. His movements are always meaſured and ſedate, and his character ſeems to correſpond with the gravity of his maſs. To accommodate thoſe who mount him, he readily learns to bend his knees. With his trunk he ſalutes his friends, uſes it for raiſing burdens, and aſſiſts in loading himſelf. He loves to be clothed, and ſeems to be proud of gaudy trappings. In the ſouthern regions, he is employed in drawing waggons, ploughs, and chariots. ‘ I was eye-witneſs,’ ſays P. Philippe, ‘ to the following facts. At Goa, there are always ſome elephants employed in ‘ the building of ſhips. I one day went to the ſide of the river, ‘ near which a large ſhip was building in the city of Goa, where ‘ there is a large area filled with beams for that purpoſe. Some ‘ men tie the ends of the heavieſt beams with a rope, which is handed to the elephant, who carries it to his mouth, and, after twiſting ‘ it round his trunk, draws it, without any conductor, to the place ‘ where the ſhip is building, though it had only once been pointed ‘ out to him. He ſometimes drew beams ſo large that more than ‘ twenty men would have been unable to move. But, what ſurpriſed ‘ me ſtill more, when other beams obſtructed the road, he elevated ‘ the ends of his own beams, that they might run eaſily over thoſe ‘ which lay in his way. Could the moſt enlightened man do ‘ more?

'more *?' When at work, the elephant draws equally, and, if properly managed, never turns reſtive. The man who conducts the animal generally rides on his neck, and employs a hooked iron road, or a bodkin, with which he pricks the head or ſides of the ears, in order to puſh the creature forward, or to make him turn. But words are commonly ſufficient. The attachment and affection of the elephant are ſometimes ſo ſtrong and durable that he has been known to die of grief, when, in an unguarded paroxyſm of rage, he had killed his guide.

Before the invention of gun-powder, elephants were employed in war by the African and Aſiatic nations. 'From time immemo-'rial,' ſays Schouten, 'the Kings of Ceylon, of Pegu, and of Ara-'can, have uſed elephants in war. Naked ſabres were tied to their 'trunks, and on their backs were fixed ſmall wooden caſtles, which 'contained five or ſix men armed with javelins, and other wea-'pons †.' The Greeks and Romans, however, ſoon became acquainted with the nature of theſe monſtrous warriors. They opened their ranks to let the animals paſs, and directed all their weapons, not againſt the elephants, but their conductors. Since fire has now become the element of war, and the chief inſtrument of deſtruction, elephants, who are terrified both at the flame and the noiſe, would be more dangerous than uſeful in our modern battles. The Indian Kings, however, ſtill arm elephants in their wars. In Cochin, and other parts of Malabar, all the warriors who fight not on foot are mounted on elephants ‡. The ſame practice obtains in Tonquin, Siam, and Pegu. In theſe countries, the kings and nobles at public feſtivals are always preceded and followed by numerous trains of elephants,

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* Voyage d'Orient. pag. 367.

† Voyage de Schouten, pag. 32.

‡ Thevenot, tom. 3. pag. 261.

elephants, pompouſly adorned with pieces of ſhining metal, and clothed with rich garments. Their tuſks are ornamented with rings of gold and ſilver; their ears and cheeks are painted with various colours; they are crowned with garlands; and a number of ſmall bells are fixed to different parts of their bodies. They delight in gaudy attire; for they are chearful and careſſing in proportion to the number and ſplendour of their ornaments. The Aſiatics, who were very anciently civilized, perceiving the ſagacity and docility of the elephant, educated him in a ſyſtematic manner, and modified his diſpoſitions according to their own manners, and the uſeful labours in which his ſtrength and dexterity could be employed.

A domeſtic elephant performs more labour than could be accompliſhed by ſix horſes; but he requires much care and a great deal of food. He is ſubject to be over-heated, and muſt be led to the water twice or thrice a-day. He eaſily learns to bathe himſelf. With his trunk he ſucks up large quantities of water, carries it to his mouth, drinks part of it, and, by elevating his trunk, makes the remainder run over every part of his body. To give ſome idea of the labour he performs, and the docility of his diſpoſitions, it is worthy of remark, that, in India, all the bales, ſacks, and tuns, tranſported from one place to another, are carried by elephants. They carry burdens on their bodies, their necks, their tuſks, and even in their mouths, by giving them the end of a rope, which they hold faſt with their teeth. Uniting ſagacity with ſtrength, they never break or injure any thing committed to their charge. From the margins of the rivers, they put weighty bundles into boats without wetting them, lay them down gently, and arrange them where they ought to be placed. When the goods are diſpoſed as their maſters direct, they examine with their trunks whether the articles are properly ſtowed; and, if a caſk or tun rolls, they go ſpontaneouſly in queſt of ſtones to prop and render it firm.

In the elephant, the ſenſe of ſmelling is acute, and he is paſſionately fond of odoriferous flowers, which he collects one by one, forms them into a noſegay, and, after gratifying his noſe, conveys them to his mouth.

In India, the domeſtic elephants, to whom the uſe of water is as neceſſary as that of air, are allowed every poſſible conveniency for bathing themſelves. The animal goes into a river till the water reaches his belly. He then lies down on one ſide, fills his trunk ſeveral times, and dexterouſly throws the water on ſuch parts as happen to be uncovered. The maſter, after cleaning and currying one ſide, deſires the animal to turn to the other, which command he obeys with the greateſt alacrity; and, when both ſides have been properly cleaned, he comes out of the river, and ſtands ſome time on the bank to dry himſelf. The elephant, though his maſs be enormous, is an excellent ſwimmer; and, of courſe, he is of great uſe in the paſſage of rivers. When employed on occaſions of this kind, he is often loaded with two pieces of cannon which admit three or four pound balls, beſide great quantities of baggage and ſeveral men fixed to his ears and his tail. When thus heavily loaded, he ſpontaneouſly enters the river and ſwims over with his trunk elevated in the air for the benefit of reſpiration. He is fond of wine and ardent ſpirits. By ſhowing him a veſſel filled with any of theſe liquors, and promiſing him it as the reward of his labours, he is induced to exert the greateſt efforts, and to perform the moſt painful taſks. The elephant, as we are informed by M. de Buſſy, quoted by the Count de Buffon, is employed in dragging artillery over mountains, and, on theſe occaſions, his ſagacity and docility are conſpicuous. Horſes or oxen, when yoked to a cannon, make all their exertions to pull it up a declivity. But the elephant puſhes the breach forward with his front, and, at each effort, ſupports the carriage with his knee, which he places againſt the wheel. He ſeems to underſtand what his *cornack*, or conductor, ſays to him. When his conductor wants him to perform any painful labour, he explains the nature of the operation, and gives the reaſons which ſhould induce him to obey. If the elephant ſhows a reluctance to the taſk, the cornack promiſes to give him wine, arrack, or any other article that he is fond of, and then the animal exerts his utmoſt efforts. But to break any promiſe made to him is extremely dangerous. Many cornacks have fallen victims to indiſcretions of this kind. 'At 'Dehan,' ſays M. de Buſſy, 'an elephant, from revenge, killed his 'cornack. The man's wife, who beheld the dreadful ſcene, took 'her two children, and threw them at the feet of the enraged ani'mal, ſaying, *Since you have ſlain my huſband, take my life alſo, as* '*well as that of my children.* The elephant inſtantly ſtopped, re'lented, and, as if ſtung with remorſe, took the eldeſt boy in its 'trunk, placed him on its neck, adopted him for its cornack, and 'would never allow any other perſon to mount it.'

From the members of the Royal Academy of Sciences, we learn ſome curious facts with regard to the manners of the Verſailles elephant. This elephant, they remark, ſeemed to know when it was mocked, and remembered the affront till it had an opportunity of revenge. A man deceived it, by pretending to throw ſome food into its mouth. The animal gave him ſuch a blow with its trunk as knocked him down, and broke two of his ribs. A painter wanted to draw the animal in an unuſual attitude, with its trunk elevated, and its mouth open. The painter's ſervant, to make it remain in this poſition, threw fruits into its mouth, but generally made only a faint of throwing them. This conduct enraged the elephant; and, as if it knew that the painter was the cauſe of this teazing impertinence, inſtead of attacking the ſervant, it eyed the maſter, and ſquirted at him from its trunk ſuch a quantity of water as ſpoiled the paper on which he was drawing. This elephant commonly made leſs uſe of its ſtrength than its addreſs. It looſed, with great eaſe and coolneſs, the buckle of a large double leathern ſtrap, with which its leg was fixed; and, as the ſervants had wrapped the buckle round with a ſmall cord, and tied many knots upon it, the creature, with much deliberation, looſed the whole, without breaking either the ſtrap or the cord.

It is remarked by le P. Vincent Marie, that the elephant, when in a domeſtic ſtate, is highly eſteemed for his gentleneſs, docility, and friendſhip to his governour. When deſtined to the immediate ſervice of princes, he is ſenſible of his good fortune, and maintains a gravity of demeanour correſponding to the dignity of his ſituation. But if, on the contrary, leſs honourable labours are aſſigned to him, he grows melancholy, frets, and evidently diſcovers that he is humbled and depreſſed. He is fond of children, careſſes them, and appears to diſcern the innocence of their manners. The Dutch voyagers relate *, that, by giving elephants what is agreeable to them, they are ſoon rendered perfectly tame and ſubmiſſive. They are ſo ſagacious, that they may be ſaid to be deſtitute of the uſe of language only. They are proud and ambitious; and they are ſo grateful for good uſage, that, as a mark of reſpect, they bow their heads in paſſing houſes where they have been hoſpitably received. They allow themſelves to be led and commanded by a child; but they love to be praiſed and careſſed. When a wild elephant is taken, the hunters tie his feet, and one of them accoſts and ſalutes him, makes apologies for binding him, proteſts that no injury is intended, tells him, that, in his former condition, he frequently wanted food, but that, henceforward, he ſhall be well treated, and that every promiſe ſhall be performed to him. This ſoothing harangue is no ſooner

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* Voyage de la Compagnie des Indes de Hollande, tom. 1. pag. 413.

finiſhed than the elephant placidly follows the hunter *. From this fact, however, we muſt not conclude that the elephant underſtands language, but that, like the dog, he has a ſtrong diſcerning faculty. He diſtinguiſhes eſteem from contempt, friendſhip from hatred, and many other emotions which are expreſſed by human geſtures and features. For this reaſon, the elephant is more eaſily tamed by mildneſs than by blows.

'I have frequently remarked,' ſays Edward Terry †, 'that the elephant performs many actions which ſeem to proceed more from 'reaſon than from inſtinct. He does every thing that his maſter 'commands. If he wants to terrify any perſon, he runs upon him 'with every appearance of fury, and, when he comes near, ſtops 'ſhort, without doing the perſon the ſmalleſt injury. When the 'maſter chooſes to affront any man, he tells the elephant, who immediately collects water and mud with his trunk, and ſquirts it 'upon the object pointed out to him. The Mogul keeps ſome elephants who ſerve as executioners to criminals condemned to death. 'When the conductor orders one of theſe animals to deſpatch the 'poor criminals quickly, he tears them to pieces in a moment with 'his feet: But, if deſired to torment them ſlowly, he breaks their 'bones one after another, and makes them ſuffer a puniſhment as 'cruel as that of the wheel.'

Next to the elephant, the dog ſeems to be the moſt docile quadruped. A wild dog is a paſſionate, ferocious, and ſanguinary animal. But, after he is reduced to a domeſtic ſtate, theſe hoſtile diſpoſitions are ſuppreſſed, and they are ſucceeded by a warm attachment, and a perpetual deſire of pleaſing. The perceptions and natural talents of

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* Voyage d'Orient. du P. Phillippe, pag. 366.

† Terry's Voyage to the Eaſt Indies, pag. 15.

of the dog are acute. When theſe are aided by inſtruction, the ſagacity he diſcovers, and the actions he is taught to perform, often excite our wonder. Thoſe animals which man has taken under his immediate protection are taught to perform artificial actions, or have their natural inſtincts improved, by three modes of inſtruction, puniſhment, reward, and imitation. More ductile in his nature than moſt other animals, the dog not only receives inſtruction with rapidity, but accommodates his behaviour and deportment to the manners and habits of thoſe who command him. He aſſumes the very tone of the family in which he reſides. Eager, at all times, to pleaſe his maſter, or his friends, he furiouſly repels beggars; becauſe he probably, from their dreſs, conceives them to be either thieves, or competitors for food.

Though every dog, as well as every man, is naturally a hunter, the dexterity of both is highly improved by experience and inſtruction. The varieties of dogs, by frequent intermixtures with thoſe of different climates, and perhaps with foxes and wolves, are ſo great, and their inſtincts are ſo much diverſified, that, even though they produce with each other, we ſhould be apt to regard them as different ſpecies. What a difference between the natural diſpoſitions of the ſhepherd's dog, the ſpaniel, and the grey-hound? The ſhepherd's dog, independently of all inſtruction, ſeems to be endowed by Nature with an innate attachment to the preſervation of ſheep and cattle. His docility is likewiſe ſo great, that he not only learns to underſtand the language and commands of the ſhepherd, and obeys them with faithfulneſs and alacrity, but, when at diſtances beyond the reach of his maſter's voice, he often ſtops, looks back, and recogniſes the approbation or diſapprobation of the ſhepherd by the mere waving of his hand. He reigns at the head of a flock, and is better heard than the voice of his maſter. His vigilance and activity produce order, diſcipline, and ſafety. Sheep and cattle are peculiarly ſubjected to his management, whom he prudently conducts and protects, and never employs force againſt them, except for the preſervation of peace and good order. But, when the flock committed to his charge is attacked by the fox, the wolf, or other rapacious animals, he makes a full diſplay of his courage and ſagacity. In ſituations of this kind, both his natural and acquired talents are exerted. Three ſhepherds dogs are ſaid to be a match for a bear, and four for a lion.

Every perſon knows the docility and ſagacity of ſuch dogs as are employed in conducting blind mendicants. Johannes Faber, as quoted by Mr Ray, informs us, that he knew a blind beggar who was led through the ſtreets of Rome by a middle ſized dog. This dog, beſide leading his maſter in ſuch a manner as to protect him from all danger, learned to diſtinguiſh not only the ſtreets, but the houſes where his maſter was accuſtomed to receive alms twice or thrice a-week. Whenever the animal came to any of theſe ſtreets, with which he was well acquainted, he would not leave it till a call had been made at every houſe where his maſter was uſually ſucceſsful in his petitions. When the beggar began to aſk alms, the dog, being wearied, lay down to reſt; but the maſter was no ſooner ſerved or refuſed, than the dog roſe ſpontaneouſly, and, without either order or ſign, proceeded to the other houſes where the beggar generally received ſome gratuity. I obſerved, ſays he, not without pleaſure and ſurpriſe, that, when a halfpenny was thrown from a window, ſuch was the ſagacity and attention of this dog, that he went about in queſt of it, lifted it from the ground with his mouth, and put it into his maſter's hat. Even when bread was thrown down, the animal would not taſte it, unleſs he received a portion of it from the hand of his maſter. Without any other inſtruction than imitation, a maſtiff, when accidentally ſhut out from a houſe which his maſter frequented, uniformly rung the bell for admittance. Dogs can be taught to go to market with money, to repair to a known butcher, and to carry home the meat in ſafety. They can be taught to dance to muſic, and to ſearch for and find any thing that is loſt *.

There is a dog at preſent belonging to a grocer in Edinburgh, who has for ſome time amuſed and aſtoniſhed the people in the neighbourhood. A man who goes through the ſtreets ringing a bell and ſelling penny pies, happened one day to treat this dog with a pye. The next time he heard the pyeman's bell, he ran to him with impetuoſity, ſeized him by the coat, and would not ſuffer him to paſs. The pyeman, who underſtood what the animal wanted, ſhowed him a penny, and pointed to his maſter, who ſtood in the ſtreet-door, and ſaw what was going on. The dog immediately ſupplicated his maſter by many humble geſtures and looks. The maſter put a penny into the dog's mouth, which he inſtantly delivered to the pyeman, and received his pye. This traffick between the pyeman and the grocer's dog has been daily practiſed for months paſt, and ſtill continues.

Dogs, horſes, and even hogs, by rewards and puniſhments, and, I am afraid, often by cruelty, may be taught to perform actions, as we have frequently ſeen in public exhibitions, which are truly aſtoniſhing. But of theſe we muſt not enter into any detail.

With regard to the horſe, the gentleneſs of his diſpoſitions, and the docility of his temper, are ſo well and ſo univerſally known, that it is unneceſſary to dwell long upon the ſubject. To give ſome idea of what inſtruction horſes receive when in a domeſtic ſtate, we ſhall mention ſome traits of their form and manners when under no

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* For theſe, and many other inſtances of the ſagacity and docility of the dog, the reader may conſult *Synopſis Quadrupedum a Joanne Raio, p. 6. &c.*

no reſtraints. In South America the horſes have multiplied prodigiouſly, and, in that thinly inhabited country, live in perfect freedom. They fly from the preſence of man. They wander about in troops, and devour, in immenſe meadows, the productions of a perpetual ſpring. Wild horſes are ſtronger, lighter, and more nervous, than the generality of thoſe which are kept in a domeſtic ſtate. They are by no means ferocious. Though ſuperior in ſtrength to moſt animals, they never make an attack. When aſſaulted, however, they either diſdain the enemy, or ſtrike him dead with their heels. They aſſociate in troops from mutual attachment, and neither make war with other animals nor among themſelves. As their appetites are moderate, and they have few objects to excite envy or diſcord, they live in perpetual peace. Their manners are gentle, and their tempers ſocial. Their force and ardour are rendered conſpicuous only by marks of emulation. They are anxious to be foremoſt in the courſe, to brave danger in croſſing a river, or in leaping a ditch or precipice; and, it is ſaid, that thoſe horſes which are moſt adventurous and expert in theſe natural exerciſes, are, when domeſticated, the moſt generous, mild, and tractable.

Wild horſes are taken notice of by ſeveral of the ancients. Herodotus mentions white wild horſes on the banks of the Hypanis in Scythia. He likewiſe tells us, that, in the northern part of Thrace, beyond the Danube, there were wild horſes covered all over with hair five inches in length. The wild horſes in America are the offſpring of domeſtic horſes originally tranſported thither from Europe by the Spaniards. The author of the hiſtory of the Buccaneers * informs us, that troops of horſes, ſometimes conſiſting of 500, are frequently met with in the iſland of St Domingo; that, when they ſee a man, they all ſtop; and that one of their number approaches

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* L'Hiſt. des Avanteur. Flibuſtiers, tom. 1. pag. 110.

to a certain diſtance, blows through his noſtrils, takes flight, and is inſtantly followed by the whole troop. He deſcribes them as having groſs heads and limbs, and long necks and ears. The inhabitants tame them with eaſe, and then train them to labour. In order to take them, gins of ropes are laid in the places where they are known to frequent. When caught by the neck, they ſoon ſtrangle themſelves, unleſs ſome perſon arrive in time to diſentangle them. They are tied to trees by the body and limbs, and are left in that ſituation two days without victuals or drink. This treatment is generally ſufficient to render them more tractable, and they ſoon become as gentle as if they had never been wild. Even when any of theſe horſes, by accident, regain their liberty, they never reſume their ſavage ſtate, but know their maſters, and allow themſelves to be approached and retaken.

From theſe, and ſimilar facts, it may be concluded, that the diſpoſitions of horſes are gentle, and that they are naturally diſpoſed to aſſociate with man. After they are tamed they never forſake the abodes of men. On the contrary, they are anxious to return to the ſtable. The ſweets of habit ſeem to ſupply all they have loſt by ſlavery. When fatigued, the manſion of repoſe is full of comfort. They ſmell it at conſiderable diſtances, can diſtinguiſh it in the midſt of populous cities, and ſeem uniformly to prefer bondage to liberty. By ſome attention and addreſs colts are firſt rendered tractable. When that point is gained, by different modes of management, the docility of the animal is improved, and they ſoon learn to perform with alacrity the various labours aſſigned to them. The domeſtication of the horſe is perhaps the nobleſt acquiſition from the animal world which has ever been made by the genius, the art, and the induſtry of man. He is taught to partake of the dangers and fatigues of war, and ſeems to enjoy the glory of victory. He encounters death with ardour and with magnanimity. He delights in the tumult of arms, and attacks the enemy with reſolution and alacrity. It is not in perils and conflicts alone that the horſe co-operates with the diſpoſitions of his maſter. He even ſeems to participate of human pleaſures and amuſements. He delights in the chace and the tournament, and his eyes ſparkle with emulation in the courſe. Though bold and intrepid, however, he does not allow himſelf to be hurried on by a furious ardour. On proper occaſions, he repreſſes his movements, and knows how to check the natural fire of his temper. He not only yields to the hand, but ſeems to conſult the inclination of his rider. Always obedient to the impreſſions he receives, he flies or ſtops, and regulates his motions ſolely by the will of his maſter.

Mr Ray, who wrote about the end of laſt century, informs us, that he had ſeen a horſe who danced to muſic, who, at the command of his maſter, affected to be lame, who ſimulated death, lay motionleſs with his limbs extended, and allowed himſelf to be dragged about, till ſome words were pronounced, when he inſtantly ſprung up on his feet *. Facts of this kind would ſcarcely receive credit, if every perſon were not now acquainted with the wonderful docility of the horſes educated by Aſtley, and other public exhibitors of horſemanſhip. In exhibitions of this kind, the docility and prompt obedience of the animals deſerve more admiration than the dexterous feats of the men.

Animals of the ox-kind, in a domeſtic ſtate, are dull and phlegmatic. Their ſenſibility and talents ſeem to be very limited. But we ſhould not pronounce raſhly concerning the genius and powers of animals in a country where their education is totally neglected. In all the ſouthern provinces of Africa and Aſia, there are many wild biſons, or

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* Raii Synopſis Animalium Quadrupedum, pag. 10.

or bunched oxen, which are taken when young and tamed. They are ſoon taught to ſubmit, without reſiſtance, to all kinds of domeſtic labour. They become ſo tractable, that they are managed with as much eaſe as our horſes. The voice of their maſter is alone ſufficient to make them obey, and to direct their courſe. They are ſhod, curried, carreſſed, and ſupplied abundantly with the beſt food. When managed in this manner, theſe animals appear to be different creatures from our oxen. The oxen of the Hottentots are favourite domeſtics, companions in amuſements, aſſiſtants in all laborious exerciſes, and participate the habitation, the bed, and the table of their maſters. As their nature is improved by the gentleneſs of their education, by the kind treatment they receive, and the perpetual attention beſtowed on them, they acquire ſenſibility and intelligence, and perform actions which one would not expect from them. The Hottentots train their oxen to war. In all their armies there are conſiderable troops of theſe oxen, which are eaſily governed, and are let looſe by the chief when a proper opportunity occurs. They inſtantly dart with impetuoſity upon the enemy. They ſtrike with their horns, kick, overturn, and trample under their feet every thing that oppoſes their fury. They run ferociouſly into the ranks, which they ſoon put into the utmoſt diſorder, and thus pave the way for an eaſy victory to their maſters *. Theſe oxen are likewiſe inſtructed to guard the flocks, which they conduct with dexterity, and defend them from the attacks of ſtrangers, and of rapacious animals. They are taught to diſtinguiſh friends from enemies, to underſtand ſignals, and to obey the commands of their maſter. When paſturing, at the ſmalleſt ſignal from the keeper, they bring back and collect the wandering animals. They attack all ſtrangers with fury, which renders them a great ſecurity againſt robbers. Theſe *brackeleys*, as they are called, know every inhabitant of the kraal, and diſcover the

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* Voyage de Cap, par Kolbe, tom. 1. pag. 160.

the ſame marks of reſpect for all the men, women, and children, as a dog does for thoſe who live in his maſter's houſe. Theſe people may, therefore, approach their cattle with the greateſt ſafety. But, if a ſtranger, and particularly an European, ſhould uſe the ſame freedom, without being accompanied with one of the Hottentots, his life would be in imminent danger *.

Notwithſtanding the many ſurpriſing actions which different quadrupeds may be taught to perform, none of them, though their organs are much more perfect than thoſe of birds, have ever been able to pronounce articulate ſounds. But many birds, without much inſtruction, learn to pronounce words, and even ſentences. In parrots, the diſtinguiſhing accuracy of their ear, the acuteneſs of their attention, and their ſtrong inſtinctive propenſity to imitate ſounds of every kind, have juſtly procured them univerſal admiration. When in a ſtate of domeſtication, the parrot learns to pronounce the common ſtreet-calls, beſide many words and phraſes occaſionally employed by the family in which he reſides. Though the limitation of his mental powers does not permit him to learn any extent of language, or the proper uſe and meaning of words, he not unfrequently diſcovers the aſſociation between the object and the ſound. A woman every morning paſſed the window, where a parrot's cage was fixed, calling ſalt. The parrot ſoon learned to imitate the call. But, before any ſound could be heard, he no ſooner caſt his eye upon the woman than he uttered her uſual call. In this, and many other ſimilar caſes, the objects and the ſounds are evidently connected in the mind of the animal. How far theſe aſſociations might be carried by a patient and perſevering education, it is difficult to determine. In this manner, however, parrots might be taught a conſiderable vocabulary of ſubſtantive nouns, or the proper names of

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* Voyage de Cap, par Kolbe, pag. 307.

of common objects. But his intellect, it is more than probable, would never reach the uſe of the verb, and other parts of ſpeech.

Beſide parrots, jays, &c. who learn to pronounce articulate ſounds, there is another race of birds whoſe docility deſerves to be mentioned. Singing birds, thoſe lively and ſpirited little animals, attempt not to articulate. But their muſical ears are as delicate and diſcerning as their voices are melodious and delightful. The vivacity, the extent of voice, and the imitative powers of theſe beautiful creatures, have at all times excited the attention and conciliated the affections of mankind. When domeſticated, theſe birds, beſide their natural notes, ſoon acquire the faculty of ſinging conſiderable parts of artificial tunes. Theſe imitations are effects of natural inſtinct. But, in exhibitions, I have ſeen linnets ſimulate death, and remain perfectly tranquil and unmoved, when ſmall cannons were fired, within an inch of their bodies, from a wooden fort. Theſe little creatures have even been taught to lay hold of a match and fire the cannons themſelves.

The docility and ſagacity of animals have always been conſidered as wonderful. But this wonder is partly the effect of inattention; for, though man is unqueſtionably the chief of the animal creation, the other animals, according to the number of inſtincts, or, which amounts to the ſame thing, according to the mental powers with which Nature has endowed them, comparatively approach to or recede from the ſagacity and genius of the human ſpecies. The whole is a graduated ſcale of intelligence. A philoſopher ſhould, therefore, contemplate and admire the whole, but ſhould never be ſurpriſed at any partial exhibitions of the general ſcene of intellect and animation.

We ſhall conclude this ſubject with a few remarks concerning the changes produced in animals by DOMESTICATION.

Climate and food are the chief cauſes which produce changes in the magnitude, figure, colour, and conſtitution, of wild animals. But, beſide theſe cauſes, there are others which have an influence upon animals when reduced to a domeſtic or unnatural ſtate. When at perfect liberty, animals ſeem to have ſelected thoſe particular zones or regions of the globe which are moſt conſonant to the nature and conſtitution of each particular tribe. There they ſpontaneouſly remain, and never, like man, diſperſe themſelves over the whole ſurface of the earth. But, when obliged by man, or by any great revolution of Nature, to abandon their native ſoil, they undergo changes ſo great, that, to recogniſe and diſtinguiſh them, recourſe muſt be had to the moſt accurate examination. If we add to climate and food, thoſe natural cauſes of alteration in free animals, the empire of man over ſuch of them as he has reduced to ſervitude, the degree to which tyranny degrades and disfigures Nature will appear to be greatly augmented. The mouflon, the ſtock from which our domeſtic ſheep have derived their origin, is comparatively a large animal. He is as fleet as a ſtag, armed with horns and ſtrong hoofs, and covered with coarſe hair. With theſe natural advantages, he dreads neither the inclemency of the ſky, nor the voracity of the wolf. By the ſwiftneſs of his courſe, he not only eſcapes from his enemies, but he is enabled to reſiſt them by the ſtrength of his body and the ſolidity of his arms. How different is this animal from our domeſtic ſheep, who are timid, weak, and unable to defend themſelves? Without the protection of man, the whole race would ſoon be extirpated by rapacious animals and by winter-ſtorms. In the warmeſt climates of Africa and of Aſia, the mouflon, who is the common parent of the ſheep, appears to be leſs degenerated than in any other region. Though reduced to a domeſtic ſtate, he has preſerved his ſtature and his hair; but the ſize of his horns is diminiſhed. The ſheep of Barbary, Egypt, Arabia, Perſia, &c. have undergone greater changes; and, in proportion as they approach toward either pole, they diminiſh in ſize, in ſtrength, in ſwiftneſs, and in courage. In relation to man, they are improved in ſome articles, and vitiated in others. Their coarſe hair is converted into fine wool. But, with regard to Nature, improvement and degeneration amount to the ſame thing; for both imply an alteration of the original conſtitution.

The ox is more influenced by nouriſhment than any other domeſtic animal. In countries where the paſture is luxuriant, the oxen acquire a prodigious ſize. To the oxen of Æthiopia and ſome provinces of Aſia, the ancients gave the appellation of *Bull-Elephants*, becauſe, in theſe regions, they approach to the magnitude of the elephant. This effect is chiefly produced by the abundance of rich and ſucculent herbage. The Highlands of Scotland, and indeed every high and northern country, afford ſtriking examples of the influence of food upon the magnitude of cattle. The oxen, as well as the horſes, in the more northern parts of Scotland, are extremely diminutive; but, when tranſported to richer paſture, their ſize is augmented, and the qualities of their fleſh are improved. The climate has likewiſe a conſiderable influence on the nature of the ox. In the northern regions of both continents, he is covered with long ſoft hair. He has likewiſe a large bunch on his ſhoulders; and this deformity is common to the oxen of Aſia, Africa, and America. Thoſe of Europe have no bunch. The European oxen, however, ſeem to be the primitive race, to which the bunched kind aſcend, by intermixture, in the ſecond or third generation. The difference in their ſize is remarkably great. The ſmall zebu, or bunched ox of Arabia, is not one tenth part of the magnitude of the Æthiopian bull-elephant.

The influence of food upon the dog-kind ſeems not to be great. In all his variations and degradations, he appears to follow the differences of climate. In the warmeſt climates, he is naked; in the northern regions, he is covered with a coarſe thick hair; and he is adorned with a fine ſilky robe in Spain and Syria, where the mild temperature of the air converts the hair of moſt quadrupeds into a kind of ſilk. Beſide theſe external variations produced by climate, the dog undergoes other changes, which proceed from his ſituation, his captivity, and the nature of the intercourſe he holds with man. His ſize is augmented or diminiſhed by obliging the ſmaller kinds to unite together, and by obſerving the ſame conduct with the larger individuals. The ſhortening of the tail and ears proceeds alſo from the hand of man. Dogs who have had their ears and tails cut for a few generations, tranſmit theſe defects, in a certain degree, to their deſcendants. Pendulous ears, the moſt certain mark of domeſtic ſervitude and of fear, are almoſt univerſal. Of many races of dogs, a few only have retained the primitive ſtate of their ears. Erect ears are now confined to the wolf-dog, the ſhepherd's dog, and the dog of the North.

The colour of animals is greatly variegated by domeſtication. The dog, the ox, the ſheep, the goat, the horſe, have aſſumed all kinds of colours, and even mixtures of colours, in the ſame individuals. The hog has changed from black to white; and white, without the intermixture of ſpots, is generally accompanied with eſſential imperfections. Men who are remarkably fair, and whoſe hair is white, have generally a defect in their hearing, and, at the ſame time, weak and red eyes. Quadrupeds which are entirely white have likewiſe red eyes and a dullneſs of hearing. The variations from the original colour are moſt remarkable in our domeſtic fowls. In a brood of chickens, though the eggs be laid by the ſame hen, and though the female be impregnated by the ſame male, not one of them has the ſame colours with another.

Domeſtication not only changes the external appearances of animals, but alters or modifies their natural diſpoſitions. The dog, for example, when in a ſtate of liberty, is a rapacious quadruped, and hunts and devours the weaker ſpecies: But, after he has ſubmitted to the dominion of man, he relinquiſhes his natural ferocity, and is converted into a mean, ſervile, patient, and paraſitical ſlave.

CHAPTER XVIII.

Of the Characters of Animals.

ON this ſubject it never was intended to paint the characters of every ſpecies, even of the larger animals. The reader will eaſily recollect, that, in many parts of this work, much has already been ſaid with regard to the tempers, diſpoſitions, and manners, of a great number of animals. Theſe we ſhall not repeat, but proceed to ſome general remarks.

On every animal Nature has imprinted a certain *character*, which is indelibly fixed, and diſtinguiſhes the ſpecies. This character we diſcover by the actions, the air, the countenance, the movements, and the whole external appearance. The courage of the lion, the ferocity of the tiger, the voraciouſneſs of the wolf, the pride of the courſer, the dullneſs and indolence of the aſs, the cunning and addreſs of the fox, the affection and docility of the dog, the ſubtlety and ſelfiſhneſs of the cat, the mildneſs of the ſheep, the timidity of the hare, the vivacity of the ſquirrel, are proper examples. Theſe characters, when under the influence of domeſtication, may be modified by education, of which rewards and puniſhments are the chief inſtruments employed. But the original character, impreſſed by the hand of Nature, is never fully obliterated. Thoſe animals which ſeem to have been deſtined by Nature to live in perpetual ſlavery under the dominion of man, have the mildeſt and moſt gentle diſpoſitions. It is pleaſant, but, at the ſame time, ſomewhat contemptible, to ſee a troop of oxen guided by the whip of a child.

In the human ſpecies, the variety of tempers, affections, averſions, and ſtudies, is indiſpenſibly neceſſary for ſupporting the ſocial ſtate, and carrying on the general buſineſs of life. Some minds are formed for ſtudy and deep reſearch, and others for action, courage, and the exertion of bodily powers. The ſame variety in the diſpoſitions and manners of the different tribes of animals is equally neceſſary for peopling the earth, and for ſupplying the reciprocal exigencies of its inhabitants.

Beſide the general ſpecific characters of animals, individual characters, eſpecially among the human race, are ſtrongly marked, and greatly variegated. In every government, and particularly in commercial ſtates, human characters, independently of the original bias, or genius, ſtamped by Nature on individual minds, are often ſo diſguiſed by a thouſand artifices, that it requires not only time, but frequent intereſting ſcenes, before a man can diſcover the real character even of an intimate companion. Many men aſſociate together in the moſt harmonious manner, and ſhow every ſymptom of friendſhip and attachment; but, when any of them happens to be diſtreſſed, and to require aid, all this apparent friendſhip inſtantly vaniſhes, the aſpect of the countenance, inſtead of exhibiting ſympathy and cordiality, is converted into a cold reſerve, and the unfortunate former companion is firſt ſhunned, and then deſerted. This picture of human nature, we are ſorry to remark, is too general; but, thank Heaven, it is not univerſal; for there always were, and ſtill are, men of noble and generous minds, who willingly ſacrifice part of their own intereſt to that of their friends.

With regard to the characters of quadrupeds, beſide the ſpecific diſpoſitions which diſtinguiſh the different kinds, each individual poſſeſſes a peculiar character by which it may be diſcriminated from any other. Theſe individual characters may be diſcovered not only by the aſpect, but by the actions of animals. Some dogs, even of the ſame race, are ſurly, churliſh, and revengeful. Others are gay, frolickſome, and friendly. The countenances of men, which always indicate ſome part of their original and genuine character, are as various as their numbers. Though leſs ſubject to general obſervation, Nature has marked the countenances of every animal, even down to the inſect tribes, with ſome characteriſtic ſtrokes, which enable them to diſtinguiſh one another, and even to contract particular attachments. To us, the ſmall birds, ſuch as ſparrows and linnets, appear to be ſo perfectly ſimilar, that, though we had an opportunity of ſeeing great numbers of them collected in one place, it would require much time and attention to be enabled to make individual diſtinctions. After they have brought up their young, they aſſociate promiſcuouſly in flocks; but, when the genial ſpring arrives, a different ſcene is exhibited. The flocks diſappear. Each male has ſelected, courted, and retired with a female to build a neſt, to hatch eggs, and to nouriſh and ſupport their young. If Nature had not ſtamped upon every individual a peculiar mark, it would be impoſſible that the immenſe multitudes who pair, or join in matrimony, ſhould be capable of diſtinguiſhing and adhering faithfully to one another. A ſhepherd, who has been long accuſtomed to ſuperintend a numerous flock, knows, by the countenances, and other natural or accidental marks, every individual. I knew a ſhepherd, who not only diſtinguiſhed every individual of above two hundred ſheep, but gave to each a particular name.

The characters of quadrupeds, and even of ſome birds, are indicated by obſcure reſemblances between the lineaments of their faces, and thoſe of men of different features and diſpoſitions. Some men, in the general expreſſion of their countenances, reſemble goats, others ſheep, others oxen, others ſwine, others lions, others dogs, others foxes, others owls, others hawks. Even in particular races of the ſame ſpecies, ſimilarities of this kind may be traced. I know ſome men who reſemble terriers, others greyhounds, others ſpaniels, others the ſhepherd's dog, others the lap-dog, &c. Some of theſe reſemblances may be regarded as fanciful, and perhaps they frequently are. But, in general, when the reſemblance to a particular animal is ſtrongly marked in a human countenance, the diſpoſitions of the man have a ſtriking affinity to thoſe of the animal. Men who reſemble the fox are uniformly cunning and deceitful. Thoſe who reſemble the ox are dull, ſtupid, and phlegmatic. Thoſe who reſemble the lion are bold, open, generous, and witty. Thoſe who reſemble the cat are circumſpect, deſigning, and avaricious. Thoſe who reſemble the greyhound are vigilant, active, and ſmart. Thoſe who reſemble the lap-dog are vain, preſumptuous, petulant, and laſcivious. Thoſe who reſemble the ſow are diſguſtful both in their appearance and in their diſpoſitions. Thoſe who reſemble a croſs-made horſe are cruel, unfeeling, and highly ſelfiſh. Thoſe who reſemble the ſpaniel, of whom the examples are numerous, are fawning, mean, and paraſitical. Thoſe who reſemble the ſheep are dull, timid, and inoffenſive. Thoſe who reſemble the goat are fanciful, obſtinate, and libidinous. Thoſe who reſemble a fine horſe are intrepid, generous, tractable, and good humoured. Thoſe who reſemble a hawk are quick, deſultory, and ingenious. Thoſe who reſemble the owl are dark, deſigning, and treacherous. Thoſe who reſemble the bee are active, ignorant, and induſtrious. It is needleſs to multiply examples. Every man's recollection and obſervation will furniſh him with numberleſs coincidences between the ſimilarities

rities in ſtructure and features to particular animals, and the form, diſpoſitions, and manners, of the men who poſſeſs them.

Compariſons have been inſtituted, and analogies traced, between the ſtructure, aſpect, and diſpoſitions, of ſome quadrupeds and thoſe of certain birds, which ſhow a uniformity in the general plan of Nature. Among birds, as well as quadrupeds, ſome ſpecies are carnivorous, and others feed upon fruits, grain, and various kinds of herbage. The eagle, which is a noble and a generous bird, repreſents the lion. The vulture, which is cruel and inſatiable, repreſents the tiger. The kite, the buzzard, and the raven, who live chiefly on offals and carrion, repreſent the hyaena, the wolf, and the jackal. The falcon, the ſparrow-hawk, and other birds employed in hunting, repreſent the dog, the fox, the lynx, &c. The owl, who ſearches for her prey in the night, repreſents the cat. The heron and the cormorant, who feed upon fiſhes, repreſent the beaver and the otter. Peacocks, hens, and all other birds which have a crop, or craw, repreſent oxen, ſheep, goats, and other ruminating animals.

CHAPTER XIX.

Of the Principle of Imitation.

IMITATION neceſſarily implies ſome degree of intelligence. All animals, particularly thoſe of the more perfect kinds, are endowed with the principle of imitation. The conſequence is obvious, that all animals poſſeſs a certain portion of intellectual power. In man, the principle of imitation appears at a very early period of his exiſtence. In the more advanced ſtages of life, this principle is ſo interwoven with other motives of acting and thinking, that it is difficult to diſtinguiſh it as a ſeparate inſtinct, and equally difficult to conquer the habits and prejudices to which it has given riſe. The leſs a man has cultivated his rational faculties, the more powerful is the principle of imitation over his actions and his habits of thinking. Moſt women, of courſe, are more influenced by the behaviour, the faſhions, and the opinions of thoſe with whom they aſſociate than men. From this almoſt irreſiſtible inſtinct, we ſhould learn the extreme danger of frequenting the company of the diſſolute and unprincipled; for bad habits are ſoon acquired, but very difficult to conquer. It is a comfortable circumſtance, however, that if men, eſpecially when young, are fortunate enough to fall in with the ſociety of the virtuous and intelligent, the principle of imitation, ſo benevolent is Nature, acts with redoubled force. If we attend to our own feelings, we muſt acknowledge, that, in the acquiſition of bad habits, there is an evident force upon our natural inclinations, but that, in virtuous aſſociations, the mind acquieſces with pleaſure, and feels no reſtraint in complying with the examples it perceives nor in acquiring the correſpondent habits. We are prone to evil; but, when not corrupted by improper imitations, Nature has made us much more prone to good.

Artificial language, which we learn entirely by imitation, diſtinguiſhes us, more than any other circumſtance, from the brute creation. The proper uſe of it likewiſe forms the chief difference between one man and another; for, by language, one man diſcovers a ſuperiority of knowledge and of genius, while others expreſs by it nothing but borrowed or confuſed ideas. In an idiot, or in a parrot, it marks only the moſt abject degree of ſtupidity. It ſhows the incapacity of either to produce a regular chain of thinking, though both of them be endowed with organs capable of expreſſing what paſſes within their minds. Men whoſe ſenſes are delicate, and whoſe minds are eaſily affected, make the beſt actors, and the beſt mimics. Children, accordingly, are extremely alert in imitating the actions, the geſtures, and the manners, of thoſe with whom they aſſociate. They are dexterous in perceiving ridiculous figures and repreſentations, which they imitate with eaſe and propriety. Hence we perceive, in the education of children, the infinite importance of regulating the principle of imitation.

The education of the inferior animals, though ſhort, is always ſucceſsful. By imitation, they ſoon acquire all the knowledge poſſeſſed by their parents. They not only derive experience from their own feelings, but, by imitation, they learn and employ the experience of others. Young animals model their actions entirely upon thoſe of the old. They ſee their ſeniors approach or fly when they perceive particular objects, hear particular ſounds, or ſmell certain odours. At firſt, they approach or fly without any other determining principle but that of imitation. Afterwards, they approach or fly ſpontaneouſly, becauſe they have then acquired the habit of approaching or flying, whenever they feel the ſame or ſimilar ſenſations. Many inſtincts, as terror upon hearing particular ſounds, the appearance of natural enemies, the ſelection of food, &c. ſeem to be partly the effects of imitation. It is remarked by Ulloa, that, in the year 1743, the dogs in Juan Fernandes had loſt the faculty of barking. When aſſociated with other dogs, it was with great difficulty that they again learned, by imitation, to bark. The cauſe of theſe dogs loſing the expreſſion of their uſual language in a domeſtic ſtate, it is not eaſy to inveſtigate. Perhaps, by the aid of experience, and their own ſagacity, they diſcovered that barking warned their prey to eſcape from danger. The jackals, however, who are conſidered as belonging to the dog-kind, not only hunt in packs, but, during the chace, make a loud and a hideous noiſe. Mr White, in his Natural Hiſtory of Selborne, a work which contains much information, and diſcovers a good and benevolent heart in the author, informs us, that he had an opportunity of ſeeing two dogs, a male and a female, which had been brought from Canton in China. Theſe dogs, which, in China, are fattened for eating, are about the ſize of an ordinary ſpaniel, and are of a pale yellow colour. ‘ When taken ‘ out into a field,’ he remarks, ‘ the bitch ſhowed ſome diſpoſition ‘ for hunting, and dwelt on the ſcent of a covey of partridges till ‘ ſhe ſprung them, giving her tongue all the time. The dogs in ‘ South America are dumb; but theſe bark much in a ſhort thick ‘ manner, like foxes; and have a ſurly ſavage demeanour, like their ‘ anceſtors, which are not domeſticated, but bred up in ſties, where ‘ they are fed for the table with rice-meal, and other farinaceous ‘ food. Theſe dogs, having been taken on board as ſoon as weaned, ‘ could not have learned much from their dam; yet they did not

‘ reliſh fleſh when they came to England. In the iſlands of the Pa-
‘ cific Ocean, the dogs are bred upon vegetables, and would not eat
‘ fleſh when offered them by our circumnavigators.’

From facts of this kind, of which a great number might be mentioned, the following obſervations naturally ariſe. Theſe Chineſe dogs, though deſcended, probably for many generations, from a race of anceſtors who never had the leaſt experience or education in hunting, preſerved their original inſtinct of ſcenting and purſuing game. The dog is a groſsly carnivorous animal; for he prefers carrion to any other kind of nouriſhment; yet the Chineſe dogs diſcovered no particular reliſh for the fleſh of animals. Thus it appears, that, by habits, acquired, not by the individual, but by a train of anceſtors, both the taſte and the conſtitution of animals may be greatly altered. From the ſame facts, however, it is equally evident, that Nature can never be entirely conquered. The moment the Chineſe dogs firſt ſaw a field, they both ſcented and hunted game. Imitation and habit ſeem to have greater effects upon the mode of living, feeding, and the corporeal fabrick, than upon the original inſtincts of the mind. Theſe dogs, even when they came to England after a long voyage, had not acquired the habit of greedily devouring, like other dogs, either freſh meat or carrion; but, on the firſt opportunity afforded to them, they diſcovered an inclination to hunt.

CHAPTER XX.

Of the Migration of Animals.

THE Hon. Daines Barrington, in his *Eſſay on the Periodical Appearing and Diſappearing of certain Birds, at different times of the year* [*], has, by many ingenious arguments, as well as curious facts, rendered it extremely probable, that no birds, however ſtrong and ſwift in their flight, can poſſibly fly over ſuch large tracts of the ocean as has been commonly ſuppoſed. He admits partial migrations or *flittings*, as he calls them, though he does not attempt to aſcertain the diſtances of theſe flittings. With regard to the ſwallows, of which there are ſeveral ſpecies in Britain, ſome naturaliſts, of whom the Hon. Daines Barrington is one, are inclined to think that they do not leave this iſland at the end of autumn, but that they lie in a torpid ſtate till the beginning of ſummer in the banks of rivers, the hollows of decayed trees, the receſſes of old buildings, the holes of ſand-banks, and in ſimilar ſituations. That ſwallows, in the winter months, have ſometimes, though very rarely, been found in a torpid ſtate, is unqueſtionably true. Neither is the inference, that, if any of them can ſurvive the winter in that ſtate, the whole of them may ſubſiſt, during the cold ſeaſon, in the ſame condition,

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[*] Phil. Tranſact. vol. 62. pag. 265, &c.

dition, in the ſmalleſt degree unnatural. Still, however, the numbers of ſwallows which appear in this iſland, as well as in all parts of Europe, during the ſummer months, are ſo very conſiderable, that, if the great body of them did not migrate to ſome other climate, they ſhould be much more frequently found in a torpid ſtate. On the contrary, when a few of them are diſcovered in that ſtate, it is regarded as a wonder even by the country people, who have the greateſt opportunities of ſtumbling upon facts of this kind. When, accordingly, a few ſwallows or martins are found torpid in winter, and have been revived by a gentle heat, the fact, and few ſuch facts there are, is carefully recorded as ſingular in all the periodical publications of Europe.

Mr Pennant informs us, from undoubted authority, that ſome quails, and other birds which are generally ſuppoſed to leave this iſland in winter, retire to the ſea-coaſts, and pick up their food among the ſea-weeds *.

‘ Quails,’ Mr Pennant remarks, ‘ are birds of paſſage; ſome entirely quitting our iſland, others ſhifting their quarters. A gentleman, to whom this work lies under great obligations, has aſſured us, that theſe birds migrate out of the neighbouring inland counties, into the hundreds of Eſſex in October, and continue there all the winter: If froſt or ſnow drive them out of the ſtubble-fields and marſhes, they retreat to the ſea-ſide, ſhelter themſelves among the weeds, and live upon what they can pick up from the algae, &c. between high and low water mark. Our friend remarks, that the time of their appearance in Eſſex coincides with that of their leaving the inland counties †.’

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* Brit. Zool. Vol. 1. pag. 210. 2d edit. 8vo.

† Pennant, ibid.

A quail, it muſt be allowed, ſeems to be very much unqualified for a long migration; for its tail is ſhort, the bird never riſes more than twenty or thirty feet from the ground, and it ſeldom flies above three hundred yards at a time. Belon, however, an author of great ſagacity and credit, tells us, that, in his paſſage from Rhodes to Alexandria, many quails, flying from north to ſouth, were taken in his ſhip. From this circumſtance, he remarks, 'I am perſuaded 'that they ſhift places; for formerly, when I ſailed out of the Iſle 'of Zant to Morea, or Negropont, in the ſpring, I obſerved quails 'flying the contrary way, at which time, alſo, a great many were 'taken in our ſhip.' This traverſe they might be enabled to accompliſh by paſſing from one iſland to another in the Mediterranean.

Inſtances of ſwallows and ſome other birds alighting on the maſts and cordage of veſſels, at conſiderable diſtances from any ſhore, are not ſo numerous as might be expected. Neither have they been often obſerved flying over ſeas in great flocks. Mr Peter Collinſon, in a letter printed in the Philoſophical Tranſactions, ſays, 'that Sir 'Charles Wager had frequently informed him, that, in one of his 'voyages home in the ſpring, as he came into ſoundings in our 'channel, a great flock of ſwallows almoſt covered his rigging; 'that they were nearly ſpent and famiſhed, and were only feathers 'and bones; but, being recruited by a night's reſt, they took their 'flight in the morning.'

M. Adanſon, in his voyage, informs us, that, about fifty leagues from the coaſt of Senegal, four ſwallows ſettled upon the ſhip, on the ſixth day of October; that theſe birds were taken; and that he knew them to be the true ſwallow of Europe, which he conjectures were then returning to the coaſt of Africa. The Hon. Daines Barrington, with more probability, ſuppoſes that theſe ſwallows, inſtead of being on their paſſage from Europe, were only flitting from the Cape de Verde iſlands to the continent of Africa, a much ſhorter flight, but to which they ſeemed to be unequal, as they were obliged, from fatigue, to light upon the ſhip, and fall into the hands of the ſailors.

Swallows, Mr Kalm remarks, appear in the Jerſies about the beginning of April. They are, on their firſt arrival, wet, becauſe they have juſt emerged from the ſea or lakes, at the bottom of which they had remained in a torpid ſtate during the whole winter. But Mr Kalm, who wiſhes to ſupport the torpidity of ſwallows during the winter, likewiſe informs us, that he himſelf met with them at ſea, nine hundred and twenty miles from any land [*].

Theſe, and ſimilar facts, the Hon. Daines Barrington endeavours to explain, by ſuppoſing that birds diſcovered in ſuch ſituations, inſtead of attempting to croſs large branches of the ocean, have been forcibly driven from ſome coaſt by ſtorms, and that they would naturally perch upon the firſt veſſel which came within their view.

In Britain, five ſpecies of ſwallows appear in ſummer and diſappear in winter. 1. The houſe-ſwallow makes its appearance about twenty days earlier than the martin, or any other of the ſwallow tribe. They are often ſeen about the 13th day of April. They diſappear about the end of September. A few days previous to their departure, they aſſemble in great flocks on the tops of houſes, churches, and trees, from whence they are ſuppoſed to take their flight. This unuſual and temporary aſſociation of numbers indicates the impulſe of ſome common inſtinct by which each individual is actuated. The houſe ſwallow is eaſily diſtinguiſhed from the other ſpecies by the ſuperior forkineſs of its tail, and by a red ſpot on the forehead, and under the chin. This ſpecies builds in chimneys, and makes its neſt of clay, but leaves the top quite open. 2. The martin is inferior in ſize to the former, and its tail is much leſs forked. The martins appear in Britain ſoon after the houſe-ſwallow. They build under the eaves of houſes: The neſt is compoſed of the ſame materials as thoſe of the houſe-ſwallow; but it is covered above, and a ſmall hole only is left in the ſide for the ingreſs and egreſs of the birds. The martins totally diſappear about the beginning of October. 3. The ſand-martin, or bank-martin, is by much the ſmalleſt of the ſwallow-kind that viſit Britain. The ſand-martins arrive very ſoon after the houſe-ſwallow, and diſappear about Michaelmas. They dig conſiderable holes in ſand-pits and in the banks of rivers, where they build their neſts, which conſiſt not of mud, like thoſe of the former ſpecies, but of graſſes and feathers laid together in a very ſlovenly manner. It is worthy of remark, that theſe birds do not employ the cavities they dig in ſummer for winter-quarters; ſince ſand-banks, ſo perforated, have been carefully ſearched in the winter, and nothing was found but empty neſts *. 4. The ſwift, or black martin of Willoughby, is the largeſt of our ſwallows, and is the lateſt of arriving in this country; for the ſwifts are ſeldom ſeen till the beginning of May, and commonly appear, not in flocks, but in pairs. Swifts, like the ſand-martins, carry on the buſineſs of incubation in the dark. They build in the cranies of caſtles, towers, and ſteeples. Straw and feathers are the materials they uſe. They diſappear very early; for they are almoſt never ſeen after the middle of Auguſt. 5. The goatſucker, which belongs to the ſwallow tribe, is likewiſe a bird of paſſage. Like the other ſwallows, it feeds upon winged inſects. But, inſtead of purſuing its prey during the day, it flies only in the night, and ſeizes moths, and other nocturnal inſects. From this circumſtance, it has not

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[*] Voy. tom. 1. pag. 24.

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* White's Natural Hiſtory of Selborne, pag. 177.

not improperly received the appellation of the *nocturnal ſwallow.* The goat-ſucker ſtays only a ſhort time in Britain. It appears not till about the end of May, and retires in the middle of Auguſt. It lays its eggs, which are commonly two, and ſometimes three, on the bare ground.

To give catalogues of the numerous birds of paſſage which frequent this iſland, as well as other countries, and to mark the times of their arrival and departure, would be deviating entirely from our plan. For circumſtances of this kind, the curious may conſult Cateſby, Klein, Linnaei Amoenitates Academicae, White, &c. But, as the periodical appearance and diſappearance of the ſwallow-tribe have given riſe to different theories and opinions, we ſhall briefly relate thoſe opinions, and conclude with ſome remarks on migration in general.

Herodotus and Proſper Alpinus mention one ſpecies of ſwallow which reſides in Egypt during the whole year *; and Mr Loten, late governour of Ceylon, aſſured Mr Pennant, that thoſe of Java never remove. If theſe be excepted, all the other known kinds retreat or migrate periodically. Swallows migrate from almoſt every climate. They remove from Norway †, from North America ‡. from Kamtſchatka §, from the temperate parts of Europe, from Aleppo ‖, and from Jamaica **.

Concerning the periodical appearance and diſappearance of ſwallows, there are three opinions adopted by different naturaliſts. The firſt and moſt probable is, that they remove from climate to climate at thoſe particular ſeaſons when winged inſects, their natural food, fails in one country or diſtrict and abounds in another, where they likewiſe find a temperature of air better ſuited to their conſtitutions. In ſupport of this opinion, we have the teſtimony, as formerly mentioned, of Sir Charles Wager, of M. Adanſon, and of many navigators. It is equally true, however, that ſome ſpecies of ſwallows have been occaſionally found in a torpid ſtate during winter. Mr Collinſon gives the evidence of three gentlemen who were eye-witneſſes to a number of ſand-martins being drawn out of a cliff on the Rhine in the month of March 1762 *. The Hon. Daines Barrington, in the year 1768, communicated to Mr Pennant, on the authority of the late Lord Belhaven, the following fact: 'That numbers 'of ſwallows have been found in old dry walls, and in ſand-hills, 'near his Lordſhip's ſeat in Eaſt Lothian; not once only, but from 'year to year; and that, when they were expoſed to the warmth of 'a fire, they revived †.' Theſe, and other facts of the ſame kind, ſeem to be uncontrovertible; and Mr Pennant infers from them, that 'we muſt divide our belief relating to theſe two ſo different opi'nions, and conclude, that one part of the ſwallow tribe migrate, 'and that others have their winter-quarters near home ‡.' But we ſhould rather incline to think, with thoſe naturaliſts who ſuppoſe that the torpid ſwallows which are occaſionally, though very rarely, diſcovered in the winter ſeaſon, have been obliged to remain behind, becauſe they were too young, weak, diſeaſed, or ſuperannuated, to undertake a long and fatiguing flight. Still, however, that the torpidity of the feathered tribes ſhould be ſolely confined to the ſwallows, is a very ſingular fact in the hiſtory of Nature. Among quadrupeds,

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* Proſp. Alp. tom. 1. pag. 198.

† Pontopp. Hiſt. Norw. ii. 98.

‡ Cateſby's Carol. v. 1. pag. 51. App. 8.

§ Hiſt. Kamtſchatka, pag. 162.

‖ Ruſſel's Alep. pag. 70.

** Phil. Tranſ. N° 36.

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* Philoſoph. Tranſact. vol. 53. pag. 101. art. 24.

† Pennant's Britiſh Zoology, vol. 2. pag. 250. 8vo edit.

‡ Ibid. 251.

drupeds, there are many ſpecies who lie in a dormant or torpid ſtate during winter. But, if the ſwallow be excepted, not a ſingle ſpecies of birds, notwithſtanding the great numbers which, at ſtated times, appear and diſappear in every corner of the globe, has ever been diſcovered in that ſtate. This circumſtance alone, though we cannot yet aſcertain the preciſe places to which different ſpecies of birds of paſſage reſort, is a moſt convincing proof of migration in general.

It has been aſſerted, and even believed, by ſome naturaliſts, that ſwallows paſs the winter immerſed under the ice, at the bottom of lakes, or beneath the waters of the ſea. Olaus Magnus, Archbiſhop of Upſal, ſeems to have been the firſt who adopted this opinion. He informs us, that ſwallows are found in great cluſters at the bottoms of the northern lakes, with mouth to mouth, wing to wing, foot to foot, and that in autumn they creep down the reeds to their ſubterraneous retreats *. ‘ That the good Archbiſhop,’ Mr Pennant archly remarks, ‘ did not want credulity in other inſtances, appears from ‘ this, that, after having ſtocked the bottoms of the lakes with birds, ‘ he ſtores the clouds with mice, which ſometimes fall in plentiful ‘ ſhowers on Norway and the neighbouring countries!’ Klein has endeavoured to ſupport the notion that ſwallows lie under water during the winter, and gives the following account of their manner of retiring, which he collected from ſome countrymen: They aſſerted, he tells us, that the ſwallows ſometimes aſſembled in numbers on a reed till it broke and ſunk them to the bottom: That their immerſion was preceded by a kind of dirge, which laſted more than a quarter of an hour: That others united, laid hold of a ſtraw with their bills, and plunged down in ſociety: That others, by clinging together with their feet, formed a large maſs, and in this manner committed themſelves to the deep †.

Two

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* Derham's Phyſ.-Theol. pag. 349.

† Klein Prod. Hiſt. Avium, pag. 205.—206.

Two reaſons ſeem to render this ſuppoſed ſubmerſion of ſwallows impoſſible. In the firſt place, no land-animal can exiſt ſo long without ſome degree of reſpiration. The otter, the ſeal, and water-fowls of all kinds, when confined under the ice, or entangled in nets, ſoon periſh; yet it is well known, that animals of this kind can remain much longer under water than thoſe who are deſtitute of that peculiar ſtructure of the heart which is neceſſary for any conſiderable reſidence beneath that penetrating element. Mr John Hunter, in a letter to Mr Pennant, informs us, 'That he had diſ-'ſected many ſwallows, but found nothing in them different from 'other birds as to the organs of reſpiration: That all thoſe animals 'which he had diſſected of the claſs that ſleep during winter, ſuch 'as lizards, frogs, &c. had a very different conformation as to thoſe 'organs: That all thoſe animals, he believes, do breathe in their 'torpid ſtate; and, as far as his experience reaches, he knows they 'do; and that, therefore, he eſteems it a very wild opinion, that 'terreſtrial animals can remain any long time under water without 'drowning.' Another argument againſt their ſubmerſion ariſes from the ſpecific gravity of the animals themſelves. Of all birds, the ſwallow tribes are perhaps the lighteſt. Their plumage, and the comparative ſmallneſs of their weight, indicate that Nature deſtined them to be almoſt perpetually on the wing in queſt of food. From this ſpecific lightneſs, the ſubmerſion of ſwallows, and their continuing for months under water, amount to a phyſical impoſſibility. Even water-fowls, when they wiſh to dive, are obliged to riſe and plunge with conſiderable exertion, in order to overcome the reſiſtence of the water. Klein's idea of ſwallows employing reeds and ſtraws as means of ſubmerſion is rather ludicrous; for theſe light ſubſtances, inſtead of being proper inſtruments for aſſiſting them to reach the bottom, would infallibly contribute to ſupport them on the ſurface, and prevent the very object of their intention. Beſides, admitting the poſſibility of their reaching the bottom of lakes and ſeas, and ſuppoſing they could exiſt for ſeveral months without reſpiration, What would be the conſequence? The whole would ſoon be devoured by otters, ſeals, and fiſhes of various kinds. Nature is always anxious for the preſervation of ſpecies. But, if the ſwallow tribes were deſtined to remain torpid, during the winter months, at the bottom of lakes and ſeas, ſhe would act in oppoſition to her own intentions; for, in a ſeaſon or two, the whole genus would be annihilated.

Mr White of Selborne has favoured us with the following information concerning the migration of ſwallows: 'If ever I ſaw,' ſays he, 'any thing like actual migration, it was laſt Michaelmas day, '1768. I was travelling, and out early in the morning: At firſt 'there was a vaſt fog; but, by the time that I was got ſeven or 'eight miles from home towards the coaſt, the ſun broke out into a 'delicate warm day. We were then on a large heath or common, 'and I could diſcern, as the miſt began to break away, great numbers of ſwallows cluſtering on the ſtinted ſhrubs and buſhes, as if 'they had rooſted there all night. As ſoon as the air became clear 'and pleaſant, they all were on the wing at once, and, by a placid 'and eaſy flight, proceeded on ſouthward towards the ſea: After 'this I did not ſee any more flocks, only now and then a ſtraggler. 'When I uſed to riſe in a morning laſt autumn, and ſee the ſwallows and martins cluſtering on the chimneys and thatch of the 'neighbouring cottages, I could not help being touched with ſecret 'delight, mixed with ſome degree of mortification: With delight, 'to obſerve with how much ardour and punctuality thoſe poor little birds obeyed the ſtrong impulſe towards migration, or hiding, 'imprinted on their minds by their great Creator; and with ſome 'degree of mortification, when I reflected, that, after all our pains 'and inquiries, we are yet not quite certain to what regions they

‘ do migrate; and are ſtill farther embarraſſed to find, that ſome do ‘ not actually migrate at all *.’

In another part of his work, Mr White ſays: ‘ But we muſt not ‘ deny migration in general; becauſe migration certainly does ſub‘ ſiſt in ſome places, as my brother in *Andaluſia* has fully informed ‘ me. Of the motions of theſe birds he has ocular demonſtration, ‘ for many weeks together, both ſpring and fall: During which pe‘ riods, myriads of the ſwallow kind traverſe the Straits from north ‘ to ſouth, and from ſouth to north, according to the ſeaſon. And ‘ theſe vaſt migrations conſiſt not only of *hirudines* (ſwallows), but ‘ of *bee birds*, *hoopoes*, *oropendulos*, or *golden thruſhes*, &c. &c. and ‘ alſo many of our *ſoft billed ſummer birds of paſſage*; and, more‘ over, of birds which never leave us, ſuch as all the various ſorts of ‘ hawks and kites. Old Belon, two hundred years ago, gives a cu‘ rious account of the incredible armies of hawks and kites, which ‘ he ſaw in the ſpring-time traverſing the Thracian Boſphorus from ‘ Aſia to Europe. Beſides the above mentioned, he remarks, that ‘ the proceſſion is ſwelled by whole troops of eagles and vultures †.’

Mr White likewiſe, with much propriety, remarks, that our inquiries concerning the migration of birds have been too much confined to the ſwallow tribes; while little attention has been paid to the ſhort-winged birds of paſſage, ſuch as quails, red-ſtarts, nightingales, white-throats, black-caps, &c. All theſe, though ſeemingly ill qualified for long flights, diſappear in the winter, and not one of them, notwithſtanding their immenſe numbers, has ever been found in a torpid ſtate.

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* White's Natural Hiſtory of Selborne, pag. 64.—65.

† Ibid. pag. 139.

To mark the times of the arrival and departure of birds of paſſage in different countries, and in different diſtricts of the ſame countries, and the probable motives ariſing from the ſtate of the country with regard to heat and cold, and to that of the food peculiar to each kind, would throw much light upon the hiſtory of migration. To Mr White of Selborne we are obliged for the following liſts of birds of paſſage which he has obſerved in his neighbourhood. Theſe liſts are arranged nearly in the order of time.

Liſt of Summer Birds of Paſſage.

Names.	*Uſually appear about*
1. Wryneck,	Middle of March.
2. Smalleſt willow-wren,	March 23.
3. Houſe-ſwallow,	April 13.
4. Martin,	Ibid.
5. Sand-martin,	Ibid.
6. Black-cap,	Ibid.
7. Nightingale,	Beginning of April.
8. Cuckoo,	Middle of April.
9. Middle willow-wren,	Ibid.
10. White-throat,	Ibid.
11. Red-ſtart,	Ibid.
12. Stone-curlew,	End of March.
13. Turtle-dove,	——
14. Graſshopper lark,	Middle of April.
15. Swift,	April 27.
16. Leſs reed-ſparrow,	——
17. Land-rail,	——
18. Largeſt willow-wren,	End of April.
19. Goat-ſucker, or fern-owl,	Beginning of May.
20. Fly-catcher,	May 12. This is the lateſt ſummer bird of paſſage.

Moſt ſoft-billed birds feed upon inſects, and not on grain or ſeeds; and, therefore, they retire before winter. But the following ſoft-billed birds, though they eat inſects, remain with us during the whole year; ſuch as the red-breaſt and wren, who frequent out-houſes and gardens during the winter, and eat ſpiders, &c.; the hedge-ſparrow, who frequents ſinks for crumbs and other ſweepings; the white wagtail, the yellow wagtail, and the gray wagtail, who frequent ſhallow rivulets near the ſpring heads, where the water ſeldom freezes, and feed upon the aureliae of inſects; the wheat-ear, ſome of which are to be ſeen during the winter, &c.

Liſt of Winter Birds of Paſſage in the neighbourhood of Selborne.

1. The ring-ouſel. This bird appears about Michaelmas week, and is a new migration lately diſcovered by Mr White.

2. The red-wing, or wind-thruſh, appears in Britain about old Michaelmas. They come in great flocks from the frozen regions of the north.

3. Field-fare. Theſe birds viſit Britain in immenſe numbers about Michaelmas, and depart about the end of February, or the beginning of March. They paſs the ſummer in the northern parts of Europe, and likewiſe in Lower Auſtria [*]. They breed in the largeſt trees, feed on berries of all kinds [†], but prefer thoſe of the juniper. It is probable that the field-fares which migrate into Britain come from Norway and the northern regions of Europe, becauſe

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[*] Kramer Elench. pag. 361.

[†] Linn. Faun. Suec. ſp. 78.

cauſe we find that they both breed and winter in Pruſſia, Auſtria *, and the more temperate climates.

4. The Royſton-crow, or hooded crow of our countryman Sir Robert Sibbald, is likewiſe a bird of paſſage. It viſits us in the beginning of winter, and departs with the wood-cocks. They frequent the inland as well as the maritime parts of Britain. When near the coaſts, they feed upon crabs, muſcles, and other ſhell-fiſhes. They breed in Sweden, build their neſts in trees, and lay four eggs †. They likewiſe breed in the ſouthern parts of Germany, and particularly on the banks of the Danube ‡.

5. The wood-cock appears in this country about old Michaelmas. During the ſummer, wood-cocks inhabit the Alps ‖, Norway, Sweden §, and the northern parts of Europe. From theſe countries they retire as ſoon as the froſt commences, which obliges them to migrate into milder climates, where the ſoil is open, and more adapted to their mode of feeding; for they live on worms, which they ſearch for with their long bills in ſoft and moiſt grounds in the midſt of woods. Wood-cocks, taking the advantage of the night, or of foggy weather, arrive here in flocks: But they ſoon ſeparate; and, before returning to their ſummer quarters, they pair. They fly and feed during the night. They begin their flight in the evening, and return to their retreats in the glades when day commences. They depart from Britain about the end of February or the beginning of March. Some of them, however, like the ſtraggling ſwallows, have been known to breed, and to remain here during the whole year.

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* Klein Hiſt. Avium. pag. 178.

† Linn. Faun. Suec. ſp. 88.

‡ Kramer, pag. 333.

‖ Willoughby's Ornithology, pag. 290.

§ M. de Geer's and Dr Wallerius's letters to Mr Pennant.

year [*]. It is likewiſe known that wood-cocks migrate from France, Germany, and Italy, and that they make choice of cold northern climates for their ſummer reſidence. About the end of October they viſit Burgundy, but remain there four or five weeks only; becauſe it is a dry country, and, on the firſt froſts, they are obliged to retire for want of ſuſtenance. In the winter, they are found as far ſouth as Smyrna, Aleppo [†], and Barbary [‡]. They are even very common in Japan [‖].

6. The ſnipe. Snipes are enrolled as birds of paſſage by Mr White, though he acknowledges that ſome of them conſtantly breed in England. ‘ In winter,’ Mr Pennant remarks, ‘ ſnipes are very ‘ frequent in all our marſhy and wet grounds, where they lie con‘ cealed in the ruſhes, &c. In the ſummer, they diſperſe to diffe‘ rent parts, and are found in the midſt of our higheſt mountains, ‘ as well as our low moors. Their neſt is made of dried graſs. ‘ They lay four eggs of a dirty olive colour, marked with duſky ‘ ſpots. Their young are ſo often found in England, that we doubt ‘ whether they ever entirely leave this iſland [§].’

7. The jack-ſnipe. This bird, which is very common in Scotland, and frequents the banks of rivers and lakes, is ranked by Mr White as a winter bird of paſſage, without mentioning either the time of its arrival or departure; and Mr Pennant is entirely ſilent on the ſubject [**].

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[*] Pennant's Britiſh Zoology, vol. 2. pag. 349. 8vo.

[†] Ruſſel's Hiſtory of Aleppo, pag. 64.

[‡] Shaw's Travels, pag. 253.

[‖] Kaempfer's Hiſt. Japan. vol. 1. pag. 129.

[§] Pennant's Britiſh Zoology, vol. 2. pag. 358. 8vo.

[**] White's Natural Hiſtory of Selborne, pag. 117.; and Pennant's Britiſh Zoology, vol. 2. pag. 359. 8vo.

8. The wood-pigeon. Mr White, without mentioning either the time of their appearing or diſappearing, tells us, that ‘ they ſeldom ‘ appear till late; nor in ſuch plenty as formerly [*].’

9. The wild-ſwan. During hard winters, this bird frequents the coaſts of Britain in large flocks; but, from any information we have been able to obtain, it does not breed in our iſland. Martin, in his Hiſtory of the Hebrides, or Weſtern Iſles [†], informs us, that wild ſwans arrive in great numbers in Lingey, one of the Hebrides, in the month of October, and remain there till March, when they retire more northward to breed. For this purpoſe, the ſwans, like moſt other water-fowls, prefer ſuch places as are leaſt frequented by mankind. During ſummer, the lakes, marſhes, and foreſts of Lapland are filled with myriads of water-fowls. In that northern region, ſwans, geeſe, the duck tribe, gooſanders, divers, &c. paſs the ſummer; but in autumn they return to us, and to other more hoſpitable ſhores [‡].

10. The wild-gooſe. The wild geeſe, it is probable, breed in the retired regions of the north. They arrive here in the beginning of winter, and frequently feed on our corn grounds. They fly at a great heighth, and obſerve regularity in their movements. They ſometimes form a ſtraight line; and, at others, they aſſume the ſhape of a wedge, which facilitates their progreſs through the reſiſting air.

With regard to the wild-duck, pochard, wigeon, and teal, though Mr White places them in the liſt of birds of paſſage, he does not mention either the times of their arrival or departure. Though it be probable that moſt of the duck-kind migrate, yet it is certain, that ſome individuals of different ſpecies of them breed in this country, and continue in it during the whole year. As to the duck-kind in general, Mr Pennant remarks: 'Of the numerous ſpecies 'that form this genus, we know of no more than five that breed 'here. The *tame ſwan* and *tame gooſe*, the *Shield duck*, the *eider* '*duck*, and a very ſmall portion of the *wild ducks*. The reſt con'tribute to form that amazing multitude of water fowl that annu'ally repair from moſt parts of Europe to the woods and lakes of 'Lapland, and other Arctic regions *, there to perform the func'tions of incubation and nutrition in full ſecurity. They and their 'young quit their retreat in September, and diſperſe themſelves over 'Europe. With us they make their appearance the beginning of 'October, circulate firſt round our ſhores, and, when compelled by 'ſevere froſt, betake themſelves to our lakes and rivers †.'

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[*] White's Natural Hiſtory of Selborne, pag. 117.

[†] Deſcription of the Weſtern Iſles, pag. 71.

[‡] Linn. Flora Lapponica, pag. 273. Oeuvres de Maupertuis, tom. 3. pag. 141.

In winter, the bernacles, or brent-ducks, appear in vaſt flocks on the north-weſt coaſts of Britain. They are very ſhy and wild; but, when taken, they ſoon grow as familiar as our domeſtic ducks. They leave the Britiſh ſhores in February, and migrate as far as Lapland, Greenland, and even Spitſbergen ‡.

The ſolan-geeſe, or gannets, are likewiſe birds of paſſage. They frequent the iſle of Ailſay, near the Frith of Clyde; the rocks adjacent to St Kilda, the moſt remote of the Hebrides; the Skelig iſles, off the coaſt of Kerry; and the Baſs iſle in the Frith of Forth. The multitudes which frequent theſe places are prodigious. To give an idea

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[*] Collect. Voyag. Dutch Eaſt India Company, 8vo, 1703. pag. 19. Cluſii Exot. pag. 368.

[†] Pennant's Britiſh Zoology, vol. 2. pag. 519.—520.

[‡] Linn. Amoen. Acad. tom. 4. pag. 585. Barent's Voyage, pag. 19.

idea of their numbers, the reader will not be diſpleaſed to ſee Dr Harvey's ſhort account of the Baſs. 'There is a ſmall iſland in the 'Frith of Forth, called the *Baſs Iſland*, which does not exceed a 'mile in circumference. The ſurface of this iſland, during the 'months of May and June, is ſo entirely covered with neſts, eggs, 'and young birds, that it is ſcarcely poſſible to walk without tread-'ing on them. The flocks of birds on the wing are ſo prodigious, 'that they darken the air like clouds, and their noiſe is ſo great, 'that a man cannot without difficulty hear his neighbour's voice. 'If, from the top of the precipice, you look down upon the ſea, 'you will ſee it on every ſide covered with infinite numbers of 'birds of different kinds, ſwimming about and hunting for their 'prey. When ſailing round the iſland, if you ſurvey the hanging 'cliffs, you will perceive, in every cragg, or fiſſure of the rocks, in-'numerable birds of various kinds, more than the ſtars of heaven 'in a ſerene night. If you view the diſtant flocks, either flying to 'or from the iſland, you will imagine them to be a vaſt ſwarm of 'bees *.' The rocks of St Kilda ſeem to be equally frequented by ſolan geeſe; for Martin, in his deſcription of the Hebrides, informs us, that the inhabitants of this ſmall iſland conſume annually no leſs than 22,600 young birds of this ſpecies, beſide an amazing number of their eggs. The ſolan geeſe and their eggs conſtitute the chief food of theſe iſlanders. They preſerve both the fowls and the eggs in ſmall pyramidal ſtone buildings, which, to protect the food from moiſture, they cover with the aſhes of turf. The ſolan geeſe are birds of paſſage. Their firſt appearance is in March, and they continue till Auguſt or September. But, in general, the times of their breeding and departure ſeem to coincide with the arrival of the herring, and the migration of that fiſh from our coaſts. It is more than probable that theſe birds attend the herrings and pilchards during their whole circuit round the Britiſh iſlands; for the appearance of the ſolan geeſe is always eſteemed by the fiſhermen as a certain preſage of the approach of the herrings or pilchards. In queſt of food, theſe birds migrate as far ſouth as the mouth of the Tagus; for they are frequently ſeen off Liſbon during the month of December.

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* Harvey de Generat. Animal. Exercit. 11.

The croſs-beak, the croſs-bill, and the ſilk-tail, are likewiſe enumerated by Mr White as birds of paſſage. 'But theſe,' ſays he, 'are only wanderers that appear occaſionally, and are not obſervant 'of any regular migration *.'

The long-legged plover, and ſanderling, viſit us in winter only; and it is worthy of remark, that every ſpecies of the curlews, wood-cocks, ſand-pipers, and plovers †, which forſake us in the ſpring, retire to Sweden, Polland, Pruſſia, Norway, and Lapland, both to feed and to breed. They return to us as ſoon as the young are able to fly; becauſe the froſts, which ſet in early in theſe countries, totally deprive them of the means of ſubſiſtance. For the ſame reaſon they leave us in ſummer, as the dryneſs and hardneſs of the ground prevent them from penetrating the earth with their bills in queſt of worms, which conſtitute the natural food of theſe birds.

From the facts which have been enumerated, and from others of a ſimilar nature, it is evident, that many birds, both of the land and water kinds, migrate from one climate to another. But, even in the ſame climate and country, birds occaſionally perform partial migrations. During hard winters, when the ſurface of the earth is covered with ſnow, many birds, as larks, ſnipes, &c. retire from

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* White's Natural Hiſtory of Selborne, pag. 118.

† Linn. Amoen. Acad. tom. 4. pag. 588. Klein de Avium Migrat. pag. 187.

from the inland parts of the country to the ſea-ſhores, where they pick up a ſcanty ſubſiſtance. Others, as the wren, the red-breaſt, and many of the ſmall birds, or ſparrow-kind, reſort to gardens, and the habitations of men. Their intention, it is obvious, is to procure food and ſhelter.

There are three principal objects of migration: Food, temperature of air, and convenient ſituations for breeding. Such birds as migrate to great diſtances are alone denominated *birds of paſſage*. But all birds are, in ſome meaſure, birds of paſſage, though they do not migrate to places ſo remote from their former abodes. At particular times of the year, moſt birds migrate from one county to another, or from the more inland diſtricts toward the ſhores. Theſe partial migrations of ſmall birds are well known to bird-catchers, who make a liveliehood by enſnaring them into their nets, and ſelling them. The birds *fly*, as the bird-catchers term it, about the end of September, and during the months of October and November. There is another, but leſs conſiderable, flight in March. Some begin their flight annually about Michaelmas; others, as the wood-larks, ſucceed, and continue their flight till the middle of October; but the green-finch does not migrate till the froſt obliges it to remove in queſt of food and ſhelter. Theſe partial migrations, or flittings, are performed from day-break till noon. Another, but ſmaller, flight commences at two o'clock, and continues till night approaches. The times when particular birds migrate from one ſituation to another are well known to the bird-catchers, who, by means of call-birds, nets, and other devices, ſeize great numbers of them, and, after accuſtoming them for ſome time to reſtraint and ſlavery, ſell them, for conſiderable prices, to curious men and whimſical women. A diligent attention to theſe partial migrations, and their motives, would ſoon unfold the cauſes of thoſe of a more extenſive kind.

Migration is generally ſuppoſed to be peculiar to the feathered tribes. This is a limited idea, which has originated from inattention to the oeconomy of Nature. Birds migrate with a view to remedy the inconveniencies of their preſent ſituation, and to acquire a more commodious ſtation with regard to food, temperature, generation, and ſhelter. From ſimilar motives, men, ſometimes in amazing multitudes, have migrated from north to ſouth, diſplaced the native inhabitants, and fixed eſtabliſhments in more comfortable climates than thoſe which they had relinquiſhed. Theſe, in their turn, have fallen victims to freſh and barbarous emigrants. Among the inhabitants of the more northern nations, as Norway, Sweden, Scotland, &c. notwithſtanding a very ſtrong attachment to their native countries, there ſeems to be a natural or inſtinctive propenſity to migrate. Poverty, the rigour of climate, curioſity, ambition, the falſe repreſentations of intereſted individuals, the oppreſſion of feudal barons, and ſimilar circumſtances, have of late given riſe to great emigrations of the human ſpecies. But, it is worthy of remark, that the emigrations from ſouth to north, except from the love of conqueſt in ambitious nations, are ſo rare, that the inſtinct ſeems hardly to exiſt in thoſe more fortunate climates. Curioſity is a general inſtinctive principle, which operates ſtrongly in the youthful periods of life, and ſtimulates every man to viſit places that are diſtant from his ordinary reſidence. This innate deſire is influenced by the relations of travellers, and by many other incentives of a more intereſted kind. Without the principle of migration, mankind, it is probable, would never have been ſo univerſally diffuſed over the ſurface of the earth. It is counterbalanced, however, by attachment to thoſe countries which gave us birth, a principle ſtill more powerful and efficient. Love of our native country is ſo ſtrong, that, after gratifying the migrating principle, almoſt every man feels a longing deſire to return.

Savages, as long as their ſtore of food remains unexhauſted, continue in a liſtleſs inactive ſtate. They exhauſt many days ſitting in perfect indolence, and ſeem not to be prompted by any motives of curioſity. They have not a conception of a man's walking either for amuſement or exerciſe. But, when their proviſions begin to fail, an aſtoniſhing reverſe takes place. They then rouſe as from a profound ſleep. In queſt of wild beaſts, birds, and fiſhes, they migrate to immenſe diſtances, exert the greateſt feats of activity, and undergo incredible hardſhips and fatigue. After acquiring a ſtore of proviſions, they return to their wonted haunts, and remain inactive till their food again begins to fail.

Quadrupeds likewiſe perform partial migrations. At the approach of winter, the ſtag, the rein-deer, and the roebuck, leave the tops of the lofty mountains, and come down to the plains and copſes. Their chief objects, in theſe flittings, are food and ſhelter. When ſummer commences, they are harraſſed with different ſpecies of winged inſects, and, to avoid theſe enemies, they regain the ſummits of the mountains, where the cold and the heighth of the ſituation protect them from the attacks of the flies. In Norway, and the more northern regions of Europe, the oxen, during the winter, migrate to the ſhores of the ſea, where they feed upon ſea-plants and the bones of fiſhes; and Pontoppidan remarks, that the cattle know by inſtinct when the tide retires, and leaves theſe articles of food upon the ſhore. In Orkney and Shetland, the ſheep in winter, for the ſame purpoſes, uniformly repair to the ſhore at the ebbing of the tides. Rats, particularly thoſe of the northern regions of Europe, appear, from time to time, in ſuch myriads, that the inhabitants of Norway and Lapland imagine the animals fall from heaven. The celebrated Linnaeus, who paid great attention to the oeconomy of theſe migrating rats, remarked, that they appeared in Sweden periodically every eighteen or twenty years. When about to migrate, they leave their wonted abodes, and aſſemble together in numbers inconceivable. In the courſe of their journey, they make tracks in the earth of two inches in depth; and theſe tracks ſometimes occupy a breadth of ſeveral fathoms. What is ſingular, the rats, in their march, uniformly purſue a ſtraight line, unleſs they are forced to turn aſide by ſome unſurmountable obſtacle. If they meet with a rock, they firſt try to pierce it, and, after diſcovering the attempt to be impracticable, they go round it, and then reſume the ſtraight line. Even a lake does not interrupt their paſſage; for they either traverſe it in a ſtraight line or periſh in the attempt; and, if they meet with a bark or other veſſel, they do not alter their direction, but climb up the one ſide of it and deſcend by the other.

Frogs, immediately after their transformation from the tadpole ſtate, leave the water, and migrate to the meadow or marſhy grounds in queſt of inſects. The numbers of young frogs which ſuddenly make their appearance in the plains induced Rondeletius, and many other naturaliſts, to imagine that they were generated in the clouds and ſhowered down upon the earth. But if, like the worthy and intelligent Mr Derham, they had examined the ſituation of the place with regard to ſtagnating waters, and attended to the nature and transformation of the animals, they would ſoon have diſcovered the real cauſe of the phenomenon.

Of all migrating animals, particular kinds of fiſhes make the longeſt journies, and in the greateſt numbers. The multiplication of the ſpecies, and the procuring of food, are the principal motives of the migration of fiſhes. The ſalmon, a fiſh which makes regular migrations, frequents the northern regions alone. It is unknown in the Mediterranean ſea, and in the rivers which fall into it both from Europe and Africa. It is found in ſome of the rivers of France that empty themſelves into the ocean *. Salmons are taken in the rivers of Kamtſchatka †, and appear as far north as Greenland. Salmons live both in the ocean and in freſh waters. For the purpoſe of depoſiting their ſpawn, they quit the ſea in the month of September, and aſcend the rivers. So ſtrong is the inſtinct of migrating, that they preſs up the rivers with amazing keenneſs, and ſcarcely any obſtacle is ſufficient to interrupt their progreſs. They ſpring, with great agility, over cataracts of ſeveral feet in heighth. In their leaps, they ſpring ſtraight up with a ſtrong tremulous motion, and do not, as has been vulgarly ſuppoſed, put their tails in their mouths. When they find a place which they think proper for depoſiting their eggs, the male and female unite their labours in forming a convenient receptacle for the ſpawn in the ſand, which is generally about eighteen inches deep. In this hole the female depoſits her eggs, and the male his milt, which they are ſaid to cover carefully with their tails; for, after ſpawning, their tails are deprived of ſkin. The eggs, when not diſturbed by violent floods, lie buried in the ſand till the ſpring, and they are hatched about the end of March. The parents, however, after this important office has been performed, haſten back to the ſea, in order to cleanſe themſelves, and to recover their ſtrength. Toward the end of March, the young fry begin to appear, and they gradually increaſe in ſize till they acquire the length of four or five inches, and are then called *ſmelts*, or *ſmoults* ‡. About the beginning of May, all the conſiderable rivers of Scotland are full of ſalmon-fry. After this period, they migrate to the ſea. About the middle of June, the earlieſt of the fry begin to appear again in the rivers. At that time they are from twelve to ſixteen inches long, and gradually augment, both in number and ſize, till about the end of July or the beginning of Auguſt, when they weigh from ſix to nine pounds. This is a very rapid growth. But a gentleman of credit at Warrington informed Mr Pennant of a growth ſtill more rapid. A ſalmon, weighing ſeven pounds and three quarters, was taken on the ſeventh day of February. It was marked on the back, fin, and tail, with ſciſſars, and then turned into the river. It was retaken on the 17th day of the following month of March, and then it weighed ſeventeen pounds and a half. The ſeaſon for fiſhing ſalmon in the Tweed begins on the 30th of November, and ends on old Michaelmas day. In that ſingle river, it is computed that no leſs than 208000, at a medium, are annually caught, which, together with the products of many other rivers on both ſides of Scotland, not only afford a wholeſome and palatable food to the inhabitants, but form no inconſiderable article of commerce.

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* Rondelet. de Fluviat. pag. 167.

† Hiſt. Kamtſchatka, pag. 143.

‡ See an Account of the Salmon Fiſhery on the River Tweed, communicated to Mr Pennant by Mr Potts, Brit. Zool. vol. 3. pag. 241. 8vo edit.

Herrings are likewiſe actuated by the migrating principle. Theſe fiſhes are chiefly confined to the northern and temperate regions of the globe. They frequent the higheſt latitudes, and are ſometimes found on the northern coaſts of France. They appear in vaſt ſhoals on the coaſt of America, as far ſouth as Carolina. In Cheſapeak Bay there is an annual inundation of herrings; and Mr Cateſby informs us, that they cover the ſhores in ſuch amazing numbers as to become offenſive to the inhabitants. The great winter rendezvous of the herrings is within, or near, the Arctic Circle, where they remain ſeveral months, and acquire ſtrength after being weakened by the fatigues of ſpawning, and of a long migration. In theſe ſeas, inſect food is much more abundant than in warmer latitudes. They begin their migration ſouthward in the ſpring, and appear off the Shetland iſlands in the months of April and May. Theſe, however, are only the forerunners of the immenſe ſhoal which arrives in June.

Their approach is recogniſed by particular ſigns, ſuch as the appearance of certain fiſhes, the vaſt number of birds, as gannets or ſolan geeſe, which follow the ſhoal to prey upon the herrings. But, when the main body arrives, its breadth and depth are ſo great as to change the appearance of the ocean itſelf. The ſhoal is generally divided into columns of five or ſix miles in length, and three or four in breadth. Their progreſſive motion creates a kind of rippling or ſmall undulations in the water. They ſometimes ſink and diſappear for ten or fifteen minutes, and then riſe again toward the ſurface. When the ſun ſhines, a variety of ſplendid and beautiful colours are reflected from their bodies. In their progreſs ſouthward, the firſt interruption they meet with is from the Shetland iſlands. Here the ſhoal divides into two branches. One branch ſkirts the eaſtern, and the other the weſtern ſhores of Great Britain, and fill every bay and creek with their numbers. Thoſe which proceed to the weſt from Shetland, after viſiting the Hebrides, where the great fiſhery is carried on, move on till they are again interrupted by the north of Ireland, which obliges them to divide a ſecond time. One diviſion takes to the weſt, where they are ſcarcely perceived, being ſoon loſt in the immenſity of the Atlantic Ocean. The other diviſion goes into the Iriſh Sea, and affords nouriſhment to many thouſands of the human race. The chief object of herrings migrating ſouthward is to depoſit their ſpawn in warmer and more ſhallow ſeas than thoſe of the Frigid Zone. This inſtinct ſeems not to be prompted by a ſcarcity of food; for, when they arrive upon our coaſts, they are fat and in fine condition; but, when returning to the ocean, they are weak and emaciated. They continue in perfection from the end of June to the beginning of winter, when they begin to depoſit their ſpawn. The great ſtations of the herring fiſheries are off the Shetland and the weſtern iſlands, and along the coaſt of Norfolk.

Beſide ſalmons and herrings, there are many fiſhes which obſerve a regular migration, as mackerels, lampreys, pilchards, &c. About the middle of July, the pilchards, which are a ſpecies of herrings, though ſmaller, appear in vaſt ſhoals off the coaſts of Cornwall. When winter approaches, like the herrings, they retire to the Arctic ſeas. Though ſo nearly allied to the herring, it is not incurious to remark, that the pilchards, in their migration for the purpoſe of ſpawning, chooſe a warmer latitude; for, off the coaſts of Britain, the great ſhoals never appear farther north than the county of Cornwal and the Scilly iſlands. Dr Borlaſe, in his hiſtory of Cornwal, gives the following account of the pilchard fiſhery: ‘ It employs,’ ſays he, ‘ a great number of men on the ſea, training them thereby ‘ to naval affairs; employs men, women, and children, at land, in ‘ ſalting, preſſing, waſhing, and cleaning, in making boats, nets, ‘ ropes, caſks, and all the trades depending on their conſtruction and ‘ ſale. The poor is fed with the offals of the captures, the land with ‘ the refuſe of the fiſh and ſalt; the merchant finds the gains of ‘ commiſſion and honeſt commerce, the fiſherman the gains of the ‘ fiſh. Ships are often freighted hither with ſalt, and into foreign ‘ countries with the fiſh, carrying off, at the ſame time, part of our ‘ tin. The uſual produce of the number of hogſheads exported ‘ each year, for ten years, from 1747 to 1756 incluſive, from the ‘ four ports of Tawy, Falmouth, Penzance, and St Ives, it appears, ‘ that Tawy has exported yearly 1732 hogſheads; Falmouth, 14631 ‘ hogſheads and two-thirds; Penzance and Mounts-Bay, 12149 ‘ hogſheads and one-third; St Ives, 1282 hogſheads: In all amounting to 29795 hogſheads. Every hogſhead, for ten years laſt paſt, ‘ together with the bounty allowed for each hogſhead exported, and ‘ the oil made out of each hogſhead, has amounted, one year with ‘ another at an average, to the price of one pound thirteen ſhillings ‘ and three pence; ſo that the caſh paid for pilchards exported has, ‘ at a medium, annually amounted to the ſum of L. 49532 : 10 : 0.’

Of the land-crab there are ſeveral ſpecies. The migration of what is called the *violet land-crab* deſerves ſome notice. It inhabits the warmer regions of Europe: But its particular reſidence is in the tropical climates of Africa and America. Land-crabs generally frequent the mountainous parts of the country, which are, of courſe, moſt remote from the ſea. They inhabit the hollows of old trees, the clefts of rocks, and holes which they themſelves dig in the earth. They are extremely numerous. In the months of April and May, they leave their retreats in the mountains, and march in millions to the ſea-ſhore. At this period the whole ground is covered with them; and a man can hardly put down his foot without treading on them *. The object of their migration is to depoſit their ſpawn on the ſea-ſhore. In their progreſs towards the ſea, like the northern rats, the land-crabs move in a ſtraight line. Even when a houſe intervenes, inſtead of deviating to the right or left, they attempt to ſcale the walls. But, when they meet with a river, they are obliged to wind along the courſe of the ſtream. In their migration from the mountains, they obſerve the greateſt regularity, and commonly divide into three battalions or bodies. The firſt conſiſts of the ſtrongeſt and boldeſt males, who, like pioneers, march forward to clear the route, and to face the greateſt dangers. The females, who form the main body, deſcend from the mountains in regular columns, which are fifty paces broad, three miles long, and ſo cloſe that they almoſt entirely cover the ground. Three or four days afterwards, the rear-guard follows, which conſiſts of a ſtraggling undiſciplined troop of males and females. They travel chiefly during the night; but, if it rains by day, (for moiſture facilitates their motion), they proceed in their ſlow uniform manner. When the ſun ſhines, and the ſurface of the ground is dry, they make an univerſal halt till the evening, and then reſume their march. When alarmed with danger, they run backward in a diſorderly manner, and hold up their nippers in a threatening poſture. They even ſeem to intimidate their enemies; for, when diſturbed, they make a clattering noiſe with their nippers. But, though they endeavour to render themſelves formidable to their enemies, they are cruel to each other. When an individual, by any accident, is ſo maimed that he cannot proceed, his companions immediately devour him, and then purſue their journey. After a fatiguing and tedious march, which ſometimes continues three months before they reach the ſhore, they prepare themſelves for depoſiting their ſpawn. The eggs ſtill remain in the bodies of the animals, and are not excluded, as uſual to this genus, under the tail. To facilitate the maturation and excluſion of the eggs, the land-crabs no ſooner arrive on the ſhore, than they approach to the margin of the ſea, and allow the waves to paſs ſeveral times over their bodies. They immediately retire to the land; the eggs, in the mean time, come nearer to maturity, and the animals once more go to the water, depoſit their eggs, and leave the event to Nature. The bunches of ſpawn are ſometimes as large as a hen's egg; and it is not incurious to remark, that, at this very period, numbers of fiſhes of different kinds are anxiouſly waiting for this annual ſupply of food. Whether the painful migration of the land-crabs, or the wonderful inſtinct of the fiſhes which await their arrival, in order to devour their ſpawn, is the moſt aſtoniſhing fact, we ſhall leave to the conſideration of philoſophers. The eggs which eſcape theſe voracious fiſhes are hatched under the ſand. Soon after, millions of minute crabs are ſeen leaving the ſhore, and migrating ſlowly toward the mountains. Moſt of the old ones, however, remain in the flat parts of the country till they regain their ſtrength. They dig holes in the earth, the mouths of which they cover with leaves and mud. Here they throw off their old ſhells, remain quite naked, and almoſt without motion for ſix days, when they become ſo fat that they are eſteemed delicious food. When the new ſhell has hardened, the animals, by an inſtinctive impulſe, march back to thoſe mountains which they had formerly deſerted. In Jamaica, where they are numerous, the land-crabs are regarded as great delicacies; and they are ſo abundant, that the ſlaves are often fed entirely upon them.

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* Voyage aux Iſles Francoiſes par Labat, tom. 2. pag. 221.

The migrating principle is not confined to men, quadrupeds, birds, and reptiles: It extends to many of the *inſect* tribes. Numberleſs inhabitants of the air paſs the firſt ſtages of their exiſtence in the waters. There they remain for longer or ſhorter periods, according to the ſpecies. Previous to their transformation into chryſalids, they quit the waters, and come upon dry ground, where they undergo their amazing change. Inſtead of active water-worms, they dig or find holes in the earth, where they are converted into chryſalids, or ſeemingly inanimated beings, and, in a ſhort time, mount into the air in the form of winged inſects. Similar migrations are to be obſerved among land-inſects. But migration is not confined to water-worms. Many ſpecies of caterpillars which feed upon the leaves of trees, ſhrubs, and other vegetables, when about to undergo their transformation, leave their former abodes, deſcend from the trees, and conceal themſelves in the earth. The hiving of bees, when numerous colonies remove in order to eſtabliſh new ſettlements, is another inſtance of the migration of inſects. Indeed, if we except bees, waſps, ants, and a few others, moſt inſects, whether they inhabit the air, the earth, or the waters, are perfect wanderers, having no fixed place of reſidence. Some of them, as the ſpider tribes, build temporary appartments; but, when diſturbed, they migrate to another commodious place, and erect new habitations.

From the facts which have been enumerated, it is apparent, that the principle of migration, or the deſire of changing ſituations, is not confined to particular birds, but extends through almoſt the whole ſyſtem of animation. Men, quadrupeds, birds, fiſhes, reptiles, inſects, all afford ſtriking examples of the migrating principle. From the ſame facts it is equally apparent, that the general motives for migrating are ſimilar in every claſs of animals. Food, multiplication of ſpecies, and a comfortable temperature of air, are evidently the chief cauſes which induce animals to remove from one place to another, or, what amounts to the ſame thing, from one climate to another. Partial emigrations, or emigrations to ſmall diſtances, are prompted by the ſame inſtinctive motives which induce animals of a different ſtructure to undertake long and fatiguing excurſions. But, previous to actual migration, what are the peculiar feelings of different animals, and what ſhould ſtimulate them to proceed uniformly in the direction that ultimately leads them to the ſituations moſt accommodated to their wants and their conſtitutions, are myſteries, with regard to which, like every other part of the oeconomy of Nature, it is the duty of philoſophers, inſtead of attempting to puſh their inquiries beyond the bounds of human ability, to obſerve a reſpectable ſilence.

CHAPTER XXI.

Of the Longevity and Diſſolution of Organiſed Bodies.

IT is a law of Nature, though a melancholy one, that all organiſed bodies ſhould be diſſolved. The periods of diſſolution, however, are as various as the ſpecies, and the intentions of Nature in producing them.

In the human kind, the brevity of life is regarded as an object of regret. One half of mankind die before they arrive at eight years of age. From that early period to eighty, beſide the deſtruction of war, and other accidents, Nature kills them annually in millions. Some inſtances may be given of men whoſe lives were prolonged beyond the uſual period of human exiſtence. Such men are not to be envied; nor ſhould they be conſidered as favourites of Nature. With reſpect to maturity of judgment, and a knowledge of the world, no man can be ſaid to exiſt till he paſſes thirty years of age. Give him thirty or thirty-five more, and, in general, both mind and body are viſibly declined. Thoſe people, therefore, who arrive at an extraordinary age may be ſaid to exiſt, but they do not live. All intellectual enjoyments and exertions, which conſtitute the chief dignity and happineſs of man, are gone. There are exceptions;

but theſe exceptions are confirmations of what we have advanced. Mankind, in the early ages of the world, have been ſaid to live for ſeveral centuries. We mean not to contradict the aſſertion. But we muſt remark, that, if ever men lived ſo long, they muſt have been very different, both in the ſtructure of their bodies and in their manners, from thoſe who now exiſt. From infancy to manhood, there is a gradual growth or extenſion of our organs. After this period, and when we advance in years, the bones harden, the muſcles turn ſtiff, the cartilages are converted into bones, the membranes into cartilages, the ſtomach and bowels loſe their tone, and the whole fabric, inſtead of being ſoft, flexible, and obedient to the inclinations, or even the commands of the mind, becomes rigid, inactive, and feeble. Theſe are the general and progreſſive cauſes of death, and they are common to all animals. There are modes of living more favourable to health than others. But examples are not wanting of men who have arrived at extreme old age, without obſerving either temperance, or any of the other modes of living which are generally ſuppoſed to be favourable to longevity. Some men, who lived temperately, and even abſtemiouſly, have reached to great ages: Others, who obſerved the very oppoſite conduct, who lived freely, and often intemperately, have had their exiſtence equally prolonged. But, in general, notwithſtanding a few exceptions, temperance, a placid and chearful diſpoſition, moderate exerciſe, and proper exertions of mind, contribute, in no uncommon degree, to the prolongation of life.

A few examples of longevity in the human ſpecies, though no general concluſions can be drawn from them, may not be incurious to the reader. We ſhall not go back to a remote and obſcure antiquity, but confine ourſelves to more modern times, when the modes of living were nearly the ſame as they are at preſent.

On this ſubject, the celebrated Lord Verulam, in his Sylva Sylvarum *, gives the following paſſage, chiefly tranſlated from the ſeventh book of Pliny's Natural Hiſtory: ‘ The year of our Lord ſeventy-ſix, falling into the time of Veſpaſian, is memorable; in which we ſhall find, as it were, a kalendar of long-lived men: For that year there was a taxing, (now a taxing is the moſt authentical and trueſt informer touching the ages of men), and in that part of Italy which lieth between the Appennine mountains and the river Po, there were found 124 perſons that either equalled or exceeded an hundred years of age, namely,

Fifty-four	of 100 years each.
Fifty-ſeven	110
Two	125
Four	130
Four	135 or 137
Three	140

Beſide theſe, Parma, in particular, afforded five, whereof,

Three were	120 years each.
Two	130
One in Bruxelles	125
One in Placentia	131
One in Faventia	132

A certain town, then called Velleiatium, ſituate in the hills about Placentia, afforded ten, whereof

Six were	110 years each.
Four	120
One in Rimino, whoſe name was Marcus Aponius	150.’

The

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* Page 293.

The moſt extraordinary inſtance of longevity in Great Britain was exhibited in the perſon of Henry Jenkins. He was a native of Yorkſhire, lived to the amazing age of 169 years, and died on the 8th day of December 1670.

Next to Jenkins, we have the famous Thomas Parre, who was a native of Shropſhire, and died on the 16th day of November 1635, at the age of 152.

Francis Conſiſt, a native of Yorkſhire, aged 150, died in January 1768.

Margaret Forſter, aged 136, and her daughter, aged 104, were natives of Cumberland, and both alive in the year 1771.

William Evans, aged 145, lived in Carnarvon, and ſtill exiſted in the year 1782.

Dumiter Radaloy, aged 140, lived in Harmenſtead, and died on the 16th day of January 1782.

James Bowels, aged 152, lived in Kilingworth, and died on the 15th day of Auguſt 1656.

The Counteſs of Deſmond, in Ireland, ſaw her 140th year.

Mr Ecleſton, a native of Ireland, lived to the age of 143, and died in the year 1691.

John Mount, a native of Scotland, ſaw his 136th year, and died on the 27th day of February 1776.

William Ellis of Liverpool died on the 16th day of Auguſt 1780, at the age of 130.

Colonel Thomas Winſloe, a native of Ireland, aged 146, died on the 22d day of Auguſt 1766.

John Taylor was born in Carrygill, in the county of Cumberland. He was bred a miner. His father died when John was only four years of age. Poverty obliged him to be ſet early to work. During two years he dreſſed lead ore for 2 d. a-day. The next three or four years he aſſiſted the miners in removing the ore and rubbiſh to the bank, for which he received 4 d. a-day. At this period there happened a great ſolar eclipſe, which was diſtinguiſhed in Scotland by the appellation of *Mirk Monday* *. This event, which he always repeated with the ſame circumſtances, is the chief aera from which John's age has been computed. After labouring many years both in this and the neighbouring kingdom, he died, near Leadhills in Scotland, in the month of May 1770, at the great age of 133.

Though the above modern examples of extraordinary longevity reſt chiefly on the authority of periodical publications, yet there is not a doubt, that, in all countries, and at all times, ſome perſons of both ſexes have arrived at ages far beyond the common periods of human life. If the reader is deſirous of ſeeing many inſtances of longevity, he may conſult Bacon's *Hiſtory of Life and Death* †, Whitehurſt's *Inquiry into the Original State and Formation of the Earth* ‡, and Dr Fothergill's *Obſervations on Longevity* ‖.

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* *Mirk*, in the Scottiſh dialect, ſignifies *dark*; and the eclipſe happened in the year 1652.

† Sylva Sylvarum, pag. 273. &c.

‡ 2d Edit. pag. 165.

‖ Annual Regiſter, Natural Hiſtory diviſion, pag. 61.

The general cauſes of death have already been mentioned. But, in women, the operation of theſe cauſes is frequently retarded. In the female ſex, the bones, the cartilages, the muſcles, as well as every other part of the body, are ſofter and leſs ſolid than thoſe of men: Neither are they generally ſo much ſubjected to bodily exertions. Their conſtituent parts, accordingly, require more time in hardening to that degree which occaſions death. Women, of courſe, ought to live longer than men. This reaſoning is confirmed by the bills of mortality; for, upon conſulting them, it appears, that, after women have paſſed a certain time, they live much longer than men who have reached the ſame period. The duration of the lives of animals may, in ſome meaſure, be eſtimated by the time occupied in their growth. An animal, or even a plant, as we learn from experience, which acquires maturity in a ſhort time, periſhes much ſooner than thoſe which are longer in arriving at that period. In the human ſpecies, when individuals grow with uncommon rapidity, they generally die young. This circumſtance ſeems to have given riſe to the common proverbial expreſſion, *Soon ripe ſoon rotten.* Man grows in ſtature till he be ſixteen or eighteen years of age; but the thickneſs of his body is not completely unfolded before that of thirty. Dogs acquire their full length in one year; but their growth in thickneſs is not finiſhed till the end of the ſecond. A man, who continues to grow for thirty years, may live ninety or a hundred: But a dog, whoſe growth terminates in two or three years, lives only ten or twelve. The ſame obſervation is applicable to moſt animals. Fiſhes continue to grow for a great number of years. Some of them, accordingly, live during ſeveral centuries; becauſe their bones and cartilages ſeldom acquire the denſity of thoſe of other animals. It may, therefore, be conſidered as a general fact, that large animals live longer than ſmall ones, becauſe the former require more time to complete their growth. Thus the cauſes of our diſſolution are inevitable; and it is equally impoſſible to retard that fatal period, as to change the eſtabliſhed laws of Nature. When the conſtitution is ſound, life may, perhaps, by moderating the paſſions, and by temperance, be prolonged for a few years. But the varieties of climate, and of the modes of living, make no material differences with regard to the period of our exiſtence, which is nearly the ſame in the European, the Negro, the Aſiatic, the American, the civilized man and the ſavage, the rich and the poor, the citizen and the peaſant. Neither does the difference of food, or of accommodation, make any change on the duration of life. Men who are fed on raw fleſh or dried fiſh, on ſago or rice, on caſſada or roots, live as long as thoſe who uſe bread and prepared victuals. If luxury and intemperance be excepted, nothing can alter thoſe laws of mechaniſm which invariably determine the number of our years. Any little differences which may be remarked in the term of human life, ſeem to be chiefly owing to the quality of the air. In general, there are more old men in high than in low countries. The mountains of Scotland, of Wales, and of Switzerland, have furniſhed more examples of longevity than the plains of Holland, Flanders, Germany, or Poland. But, if we take a ſurvey of mankind, whatever be the climate they inhabit, or their mode of living, there is ſcarcely any difference in the duration of life. When men are not cut off by accidental diſeaſes, individuals may every where be found who live ninety or a hundred years. Our anceſtors, with few exceptions, never exceeded this period; and, ſince the days of David King of the Jews, it has undergone no variation. Beſide accidental diſeaſes, which are more frequent, as well as more dangerous, in the latter periods of life, old men are ſubjected to natural infirmities that originate ſolely from a decay of the different parts of the body. The muſcles loſe their tone, the head ſhakes, the hands tremble, the limbs totter, the ſenſibility of the nerves is blunted, the cavities of the veſſels contract, the ſecretory organs are obſtructed, the blood, the lymph, and the other fluids, extravaſate, and produce all thoſe ſymptoms and diſeaſes which are commonly aſcribed to a vitiation of the humours. The natural decay of the ſolids, however, appears to be the original cauſe of all theſe maladies. It is true, that a bad ſtate of the fluids proceeds from a depravity in the organization of the ſolids. But the effects reſulting from a noxious change in the fluids produce the moſt alarming ſymptoms. When the fluids ſtagnate, or if, by a relaxation of the veſſels, an extravaſation takes place, they ſoon corrupt, and corrode the weaker parts of the ſolids. Hence the cauſes of diſſolution gradually, but perpetually, multiply, our internal enemies grow more and more powerful, and at laſt put a period to our exiſtence.

With regard to *Quadrupeds*, the cauſes of their diſſolution are preciſely the ſame with thoſe which deſtroy the human ſpecies. The times of their growth bear, likewiſe, ſome proportion to the duration of their lives. But, as we have already given a Table of the ages at which different quadrupeds are capable of multiplying their ſpecies, and of the general duration of their lives, to avoid unneceſſary repetitions, we muſt refer the reader to page 283. of this work.

Some *Birds* afford inſtances of great longevity. In this claſs of animals, the duration of life is by no means proportioned to the times of their growth. Moſt of them acquire their full dimenſions in a few months, and are capable of multiplying the ſpecies the firſt ſpring or ſummer after they are hatched. In proportion to the ſize of their bodies, birds are much more vivacious, and live longer than either men or quadrupeds. Swans have been ſaid to live three hundred years; but, though mentioned by reſpectable writers, the aſſertion is not ſupported by any authentic evidence. Mr Willoughby, in his Ornithology *, remarks, ‘ We have been aſſured by a

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* Page 14.

‘ friend of ours, a perſon of very good credit, that his father kept ‘ a gooſe known to be fourſcore years of age, and as yet ſound and ‘ luſty, and like enough to have lived many years longer, had he ‘ not been forced to kill her for her miſchievouſneſs, worrying and ‘ deſtroying the young geeſe and goſlings.’ In another part of his valuable work, Mr Willoughby tells us, ‘ that he has been aſſured ‘ by credible perſons, that a gooſe will live a hundred years or ‘ more *.’ In man and quadrupeds, the duration of life bears ſome proportion to the times of their growth. But, in birds, their growth, and their powers of reproduction, are more rapid, though they live proportionally longer. Some ſpecies of birds, as all the gallinaceous tribes, can make uſe of their limbs the moment they iſſue from the ſhell; and, in a month or five weeks after, they can likewiſe employ their wings. A dung-hill cock has the capacity of engendering at the age of four months, but does not acquire his full growth in leſs than a year. The ſmaller birds are perfect in four or five months. They grow more rapidly, and produce much ſooner than quadrupeds, and yet they live proportionally much longer. In man and quadrupeds, the duration of life is about ſix or ſeven times more than that of their growth. According to this rule, a cock or a parrot, who arrive at their full growth and powers in one year, ſhould not live above ſix or ſeven. But Nature knows none of our rules. She accommodates her conduct, not to our ſhallow, and often preſumptuous concluſions, but to the preſervation of ſpecies, and to the ſupport and general balance of the great ſyſtem of animated beings. Ravens, though capable of providing for themſelves in leſs than a year, ſometimes have their lives protracted more than a century. The Count de Buffon informs us, that, in ſeveral places of France, ravens have been known to arrive at this extraordinary age, and that,

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* Ornithology, page 256.

that, at all times, and in all countries, they have been eſteemed birds of great longevity [*].

'Eagles,' ſays Mr Pennant, 'are remarkable for their longevity, 'and for their power of ſuſtaining a long abſtinence from food. A 'golden eagle, which has now been nine years in the poſſeſſion of 'Owen Holland, Eſq; of Conway, lived thirty-two years with the 'gentleman who made him a preſent of it; but what its age was 'when the latter received it from Ireland is unknown. The ſame 'bird alſo furniſhes a proof of the truth of the other remark, having once, through the neglect of ſervants, endured hunger for 'twenty-one days, without any ſuſtenance whatſoever [†].' The pelican that was kept at Mechlin in Brabant during the reign of the Emperor Maximilian, was believed to be eighty years of age. 'What is reported of the age of eagles and ravens,' ſays Mr Willoughby, 'although it exceeds all belief, yet doth it evince that 'thoſe birds are very long-lived [‡].' Pigeons have been known to live from twenty to twenty-two years. Even the ſmaller birds live very long in proportion to the time of their growth and the ſize of their bodies. Linnets, gold-finches, &c. often live in cages fifteen, twenty, and even twenty-three years.

Fiſhes, whoſe bones are more cartilaginous than thoſe of men and quadrupeds, are long of acquiring their utmoſt growth, and many of them live to great ages. Geſner gives an inſtance of a carp in Germany which he knew to be one hundred years old [‖]. Buffon informs us, that, in the Count Maurepa's ponds, he had ſeen carps of one hundred and fifty years of age, and that the fact was atteſted in

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[*] Hiſt. Nat. des Oiſeaux, tom. 3. pag. 32.

[†] Britiſh Zoology, vol. 1. 8vo edit. page 123.

[‡] Ornithology, page 14.

[‖] Geſner de Piſc. pag. 312.

in the moſt ſatisfactory manner. He even mentions one which he ſuppoſed to be two hundred years old *. Two methods have been deviſed for aſcertaining the age of fiſhes, namely, by the circles of the ſcales, and by a tranſverſe ſection of the back-bone. When a ſcale of a fiſh is examined by the microſcope, it is found to conſiſt of a number of circles within one another, reſembling, in ſome meaſure, thoſe rings that appear on the tranſverſe ſections of trees, by which their ages are computed. In the ſame manner, the ages of fiſhes may be aſcertained by the number of circles on their ſcales, reckoning for each ring one year of the animal's exiſtence. The ages of Buffon's carps were chiefly determined by the circles on their ſcales. The age of fiſhes that want ſcales, as the ſkate and ray-kind, may be pretty exactly known by ſeparating the joints of the back-bone, and obſerving minutely the number of rings which the ſurface exhibits. Both of theſe methods may be liable to deception; but they are the only natural ones which have hitherto been diſcovered. The longevity of fiſhes has been aſcribed to ſeveral cauſes. The element in which they live is more uniform, and leſs ſubject to accidental changes than the air of our atmoſphere. Their bones, which are more of a cartilaginous nature than thoſe of land animals, admit of indefinite extenſion; of courſe, their bodies, inſtead of ſuffering the rigidity of age at an early period, which is the natural cauſe of death, continue to grow much longer than thoſe of moſt land-animals.

As to the age of *Reptiles*, probably from the unintereſting nature of the animals, we have very little information. But two letters of J. Arſcott, Eſq; of Tehott in Devonſhire, concerning the longevity of a *toad*, deſerve ſome notice. Theſe letters were addreſſed to Dr Milles, Dean of Exeter, and by him communicated to Mr Pennant in the year 1768: 'It would give me the greateſt pleaſure,' ſays Mr Arſcott, 'to be able to inform you of any particulars worthy Mr 'Pennant's notice, concerning the toad who lived ſo many years 'with us, and was ſo great a favourite.—It had frequented ſome 'ſteps before the hall-door ſome years before my acquaintance com'menced with it, and had been admired by my father for its ſize, '(which was of the largeſt I ever met with), who conſtantly paid it 'a viſit every evening. I knew it myſelf above *thirty* years, and, 'by conſtantly feeding it, brought it to be ſo tame, that it always 'came to the candle, and looked up, as if expecting to be taken up 'and brought upon the table, where I always fed it with inſects of 'all ſorts.—You may imagine that a toad, generally deteſted, (al'though one of the moſt inoffenſive of all animals), ſo much taken 'notice of and befriended, excited the curioſity of all comers to the 'houſe, who all deſired to ſee it fed; ſo that even ladies ſo far con'quered the horrors inſtilled into them by nurſes, as to deſire to ſee 'it *.' In the ſecond letter, Mr Arſcott remarks, 'I cannot ſay 'how long my father had been acquainted with the toad before I 'knew it; but, when I was firſt acquainted with it, he uſed to men'tion it as the old toad I have known ſo many years; I can anſwer 'for *thirty-ſix* years †.'—'In reſpect to its end, had it not been for 'a tame raven, I make no doubt but it would have been now living, 'who one day, ſeeing it at the mouth of its hole, pulled it out, and, 'though I reſcued it, pulled out one eye, and hurt it ſo, that, not'withſtanding its living a twelvemonth, it never enjoyed itſelf, and 'had a difficulty in taking its food, miſſing the mark for want of 'its eye. Before that accident it had all the appearance of perfect 'health ‡.'

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* Epoques de la Nature, pag. 181.

Moſt

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* Pennant's Britiſh Zoology, vol. 3. pag. 323.

† Ibid. pag. 326.

‡ Ibid. pag. 331.

Moſt *Inſects*, eſpecially after their laſt transformation, are ſhort-lived. But the ſpecies are continually ſupported by their wonderful fecundity. Thoſe animals whoſe parts require a long time of hardening and expanding are endowed with a proportional degree of longevity. Inſects grow, and their bodies harden, more quickly than thoſe of larger animals. Many of them complete their growth in a few weeks, and even in a few days. The duration of their exiſtence is accordingly limited to very ſhort periods. Some ſpecies of flies lie in a torpid ſtate during the winter, and revive when the heat of ſpring or ſummer returns. The ephemeron flies, of which there are ſeveral kinds, ſeldom live above one day, or one hour, after their transformation. But, to continue the ſpecies, Nature has taken care that myriads of males and females ſhould be transformed nearly at the ſame inſtant. Were it otherwiſe, the males and females could have no opportunity of meeting, and the ſpecies would ſoon be extinguiſhed. Other kinds are transformed more irregularly, and live ſeveral days. Here the wiſdom of Nature is conſpicuous: She prolongues the exiſtence of theſe animals for no other purpoſe but to allow the individuals of both ſexes to meet and multiply the ſpecies. Bees, and flies of all kinds, after lying long in water, and having every appearance of death, revive by the application of a gentle heat, or by covering their bodies with aſhes, chalk, or ſand, which abſorb the ſuperfluous moiſture from their pores. Reaumur made many experiments upon the reviviſcence of drowned bees. He found, that, after being immerſed in water for nine hours, ſome of them returned to life; but he acknowledges that many of them, in the fourth part of this time, were actually dead, and that neither heat, nor the application of abſorbent powders, could reſtore them to life. Analogical reaſoning is often deceitful, but it frequently leads to uſeful truths. As flies of all kinds, after immerſion in water, and exhibiting every mark of actual death, can be reſtored to life by covering their bodies with any abſorbent ſubſtance, without the aſſiſtance of a heat ſuperior to that of the common atmoſphere, might not the ordinary methods employed for the recovery of drowned perſons be aſſiſted by the application of warm aſhes or chalk? The ſtructure of a fly and that of a man, it is allowed, are very different. But, in deſperate caſes, when every other method fails, no fact ſhould be overlooked, and no analogy deſpiſed.

Plants differ as much in the periods of their exiſtence as animals. Many plants periſh yearly; others are biennial, triennial, &c. But the longevity and magnitude of particular trees are prodigious. We are informed by Mr Evelyn, that, in the bodies of ſome Engliſh oaks, when cut tranſverſely, three, and even four, hundred rings of wood have been diſtinguiſhed. A ring of wood is added annually to the trunks of trees; and, by counting the rings, the age of any tree may be pretty exactly aſcertained *. With regard to the magnitude of oaks, ſome of them are huge maſſes. Dr Hunter, in his Notes upon Evelyn's Sylva, remarks, that none 'of the oaks mentioned by Mr Evelyn bear any proportion to one now growing at 'Cowthorpe, near Wetherby, upon an eſtate belonging to the Right 'Hon. Lady Stourton. The dimenſions are almoſt incredible. Within three feet of the ſurface, it meaſures ſixteen yards, and, cloſe by 'the ground, twenty-ſix yards. Its height, in its preſent and ruinous ſtate, (1776), is about eighty-five feet, and its principal limb 'extends ſixteen yards from the bole.—When compared to this, all 'other trees are but *children* of the foreſt †.'

From the facts which have been enumerated, it appears, that all animals, as well as vegetables, have ſtated periods of exiſtence, and that their diſſolution is uniformly accompliſhed by a gradual hardening

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* See Evelyn's Sylva, page 505.

† Ibid. page 500.

ing and deſiccation of their conſtituent parts. No art, no medicine, can retard the operations of Nature. It is, therefore, the wiſdom and the duty of every human being to ſail down the irreſiſtible current of Nature with all poſſible tranquillity and reſignation. Life, whether ſhort or long, whether fortunate or unfortunate, when the fatal period arrives, is of little conſequence to the individual. Society, knowledge, virtue, and benevolence, are our only rational enjoyments, and ought to be cultivated with diligence.

With regard to animals in general, the actual duration of their lives is very different. But the comparative ſhortneſs or length of life, in particular animals, probably depends on the quickneſs or ſlowneſs of the ideas which paſs in their minds, or of the impreſſions made upon their ſenſes. A rapid ſucceſſion of ideas or impreſſions makes time ſeem proportionally long. There is likewiſe a connection between the quickneſs and ſlowneſs of ideas, and the circulation of the blood. A man whoſe pulſe is ſlow and ſluggiſh, is generally dull and phlegmatic. Raiſe this ſame man's pulſe with wine, or any other exhilarating ſtimulus, and you immediately quicken his ſenſations, as well as the train of his ideas. In all young animals, the circulation of the blood is much more rapid than after they have acquired their full growth. Young animals, accordingly, are frolickſome, vivacious, and happy. But, when their growth is completed, the motion of the blood is ſlower, and their manners, of courſe, are more ſedate, gloomy, and penſive. Another circumſtance merits attention. The circulation of the blood is ſlower or quicker in proportion to the magnitude of animals. In large animals, ſuch as man and quadrupeds, the blood moves ſlowly, and the ſucceſſion of their ideas is proportionally ſlow. In the more minute kinds, as mice, ſmall birds, ſquirrels, &c. the circulation is ſo rapid that the pulſes of their arteries cannot be counted. Now, animals of this deſcription aſtoniſh us with the quickneſs of their movements, the vivacity of their manners, and the extreme chearfulneſs of their diſpoſitions.

Reaumur, Condillac, and many other philoſophers, conſider duration as a relative idea, depending on a train of conſcious perception and ſentiment. It is certain that the natural meaſure of time depends ſolely on the ſucceſſion of our ideas. Were it poſſible for the mind to be totally occupied with a ſingle idea for a day, a week, or a month, theſe portions of time would appear to be nothing more than ſo many inſtants. Hence a philoſopher often lives as long in one day, as a clown or a ſavage does in a week or a month ſpent in mental inactivity and want of thought.

This ſubject ſhall be concluded with a ſingle remark: If it be true, and we are certain that it is ſo in part, that animals of every ſpecies, whatever be the real duration of their lives, from a ſlow or rapid ſucceſſion of ideas, and perhaps from the comparative intenſity of their enjoyments, live equally long, and enjoy an equal portion of individual happineſs, it opens a wonderful view of the great benevolence of Nature. To ſtore every portion of this globe with animal life, She has amply peopled the earth, the air, and the waters. The multifarious inhabitants of theſe elements, as to the actual duration of their lives, are extremely diverſified. But, by variation of forms, of magnitude, of rapidity of ideas, of intenſity of pleaſures, and, perhaps, of many other circumſtances, She has conferred upon the whole nearly an equal portion of happineſs.

CHAPTER XXII.

Of the Progreſſive Scale or Chain of Beings in the Univerſe.

TO men of obſervation and reflection, it is apparent, that all the beings on this earth, whether animals or vegetables, have a mutual connection and a mutual dependence on each other. There is a graduated ſcale or chain of exiſtence, not a link of which, however ſeemingly inſignificant, could be broken without affecting the whole. Superficial men, or, which is the ſame thing, men who avoid the trouble of ſerious thinking, wonder at the deſign of producing certain inſects and reptiles. But they do not conſider that the annihilation of any one of theſe ſpecies, though ſome of them are inconvenient, and even noxious to man, would make a blank in Nature, and prove deſtructive to other ſpecies who feed upon them. Theſe, in their turn, would be the cauſe of deſtroying other ſpecies, and the ſyſtem of devaſtation would gradually proceed, till man himſelf would be extirpated, and leave this earth deſtitute of all animation.

In the chain of animals, man is unqueſtionably the chief or capital link, and from him all the other links deſcend by almoſt imperceptible gradations. As a highly rational animal, improved with ſcience and arts, he is, in ſome meaſure, related to beings of a ſuperior order, wherever they exiſt. By contemplating the works of Nature, he even riſes to ſome faint ideas of her great Author. Why, it has been aſked, are not men endowed with the capacity and powers of angels? beings of whom we have not even a conception. With the ſame propriety, it may be aſked, Why have not beaſts the mental powers of men? Queſtions of this kind are the reſults of ignorance, which is always petulant and preſumptuous. Every creature is perfect, according to its deſtination. Raiſe or depreſs any order of beings, the whole ſyſtem, of courſe, will be deranged, and a new world would be neceſſary to contain and ſupport them. Particular orders of beings ſhould not be conſidered ſeparately, but by the rank they hold in the general ſyſtem. From man to the minuteſt animalcule which can be diſcovered by the microſcope, the chaſm ſeems to be infinite: But that chaſm is actually filled up with ſentient beings, of which the lines of diſcrimination are almoſt imperceptible. All of them poſſeſs degrees of perfection or of excellence proportioned to their ſtation in the univerſe. Even among mankind, which is a particular ſpecies, the ſcale of intellect is very extenſive. What a difference between an enlightened philoſopher and a brutal Hottentot? Still, however, Nature obſerves, for the wiſeſt purpoſes, her uniform plan of graduation. In the human ſpecies, the degrees of intelligence are extremely varied. Were all men philoſophers, the buſineſs of life could not be executed, and neither ſociety, nor even the ſpecies, could long exiſt. Induſtry, various degrees of knowledge, different diſpoſitions, and different talents, are great bonds of ſociety. The Gentoos, from certain political and religious inſtitutions, have formed their people into different caſts or ranks, out of which their poſterity can never emerge. To us, ſuch inſtitutions appear to be tyrannical, and reſtraints on the natural liberty of man. In ſome reſpects they are ſo: But they ſeem to have been originally reſults of wiſdom and obſervation; for, independently of all political inſtitutions, Nature herſelf has formed the human ſpecies into caſts or ranks. To ſome ſhe gives ſuperior genius and mental abilities; and, even of theſe, the views, the purſuits, and the taſtes, are moſt wonderfully diverſified.

In the talents and qualities of quadrupeds of the ſame ſpecies, there are often remarkable differences. Theſe differences are conſpicuous in the various races of horſes, dogs, &c. Even among the ſame races, ſome are bold, ſprightly, and ſagacious. Others are comparatively timid, phlegmatic, and dull.

Our knowledge of the chain of intellectual and corporeal beings is very imperfect; but what we do know gives us exalted ideas of that variety and progreſſion which reign in the univerſe. A thick cloud prevents us from recogniſing the moſt beautiful and magnificent parts of this immenſe chain of being. We ſhall endeavour, however, to point out a few of the more obvious links of that chain, which falls under our own limited obſervation.

Man, even by his external qualities, ſtands at the head of this world. His relations are more extenſive, and his form more advantageous, than thoſe of any other animal. His intellectual powers, when improved by ſociety and ſcience, raiſe him ſo high, that, if no degrees of excellence exiſted among his own ſpecies, he would leave a great void in the chain of being. Were we to conſider the characters, the manners, and the genius of different nations, of different provinces and towns, and even of the members of the ſame family, we ſhould imagine that the ſpecies of men were as various as the number of individuals. How many gradations may be traced between a ſtupid Huron, or a Hottentot, and a profound philoſopher? Here the diſtance is immenſe; but Nature has occupied the whole by almoſt infinite ſhades of diſcrimination.

In deſcending the ſcale of animation, the next ſtep, it is humiliating to remark, is very ſhort. Man, in his loweſt condition, is evidently linked, both in the form of his body and the capacity of his mind, to the large and ſmall orang-outangs. Theſe again, by another ſlight gradation, are connected to the apes, who, like the former, have no tails. It is wonderful that Linnaeus, and many other naturaliſts, ſhould have overlooked this gradation in the ſcale of animals, and maintained, that the iſland of Nicobar, and ſome other parts of the Eaſt Indies, were inhabited by tailed men. Before thoſe animals whoſe external figure has the greateſt reſemblance to that of man, are ornamented, or rather deformed, with tails, there are ſeveral ſhades of diſcrimination. The larger and ſmaller orang-outangs, which are real brutes, have no tails. Neither are the numerous tribes of apes furniſhed with this appendage. But the believers in tailed men gravely tell us, that there is nothing ſurpriſing in this phenomenon, becauſe a tail is only a prolongation of the *os coccygis*, which is the termination of the back-bone. They conſider not, however, that, inſtead of accounting for the exiſtence of tailed men, they do nothing more than ſubſtitute a learned circumlocution for the ſimple word *tail*. It is here worthy of remark, that a philoſopher, who has paid little attention to natural hiſtory, is perpetually liable to be deceived; and that a naturaliſt, I mean a nomenclator, without philoſophy, though he may be uſeful by mechanically marking diſtinctions, is incapable of enriching our minds with general ideas. A proper mixture of the two is beſt calculated to produce a real philoſopher. From the orang-outangs and apes to the baboons, the interval is hardly perceptible. The true apes have no tails, and thoſe of the baboons are very ſhort. The monkeys, who form the next link, have long tails, and terminate this partial chain of imitative animals, which have ſuch a deteſtable reſemblance to the human frame and manners.

When examining the characters by which beings are diſtinguiſhable from each other, we perceive that ſome of them are more general, and include a greater variety than others. From this circumſtance all our diſtributions into claſſes, orders, genera, and ſpecies, are derived. Between two claſſes, or two genera, however, Nature always exhibits intermediate productions ſo cloſely allied, that it is extremely difficult to aſcertain to which of them they belong. The polypus, which multiplies by ſhoots, or by ſections, from its body, connects the animal to the vegetable kingdom. Thoſe worms which lodge in tubes compoſed of ſand, ſeem to link the inſects to the ſhell and cruſtaceous animals. Shell-animals and cruſtaceous inſects make alſo a near approach to each other. Both of them have their muſcles and inſtruments of motion attached to external inſtead of internal bones. From reptiles, the degrees of perfection in animal life and powers move forward in a gradual but perceptible manner. The number of their organs of ſenſe, and the general conformation of their bodies, begin to have a greater analogy to the ſtructure of thoſe animals which we are accuſtomed to conſider as belonging to the more perfect kinds. The ſnake, by its form, its movements, and its mode of living, is evidently connected with the eel and the water-ſerpent. Like reptiles, moſt fiſhes are covered with ſcales, the colours and variety of which often enable us to diſtinguiſh one ſpecies from another. The forms of fiſhes are exceedingly various. Some are long and ſlender; others are broad and contracted. Some fiſhes are flat, others cylindrical, triangular, ſquare, circular, &c. The fins of fiſhes, from the medium in which they live, are analogous to the wings of birds. Like thoſe of reptiles, the heads of fiſhes are immediately connected to their bodies, without the intervention of necks. The flying fiſhes, whoſe fins reſemble the wings of bats, form one link which unites the fiſhes to the feathered tribes. Aquatic birds ſucceed, by a gentle gradation, the flying fiſhes.

In tracing the gradations from fiſhes to quadrupeds, the tranſition is almoſt imperceptible. The ſea-lion, the morſe, all the cetaceous tribes, the crocodile, the turtle, the ſeals, have ſuch a reſemblance, both in their external and internal ſtructure, to terreſtrial quadrupeds, that ſome naturaliſts, in their methodical diſtributions, have ranked them under the ſame claſs of animals. The bats and the flying ſquirrels, who traverſe the air by means of membranous inſtead of feathered wings, evidently connect quadrupeds with birds. The oſtrich, the caſſowary, and the dodo, who rather run than fly, form another link between the quadruped and the bird.

All the ſubſtances we recogniſe on this earth may be divided into organiſed and animated, organiſed and inanimated, and unorganiſed, or brute matter. The whole of theſe poſſeſs degrees of perfection, of excellence, or of relative utility, proportioned to their ſtations or ranks in the univerſe. Change theſe ſtations or ranks, and another world would be neceſſary to contain and ſupport them. Beings muſt not be contemplated individually, but by their rank, and the relations they have to the conſtituent parts of the general ſyſtem of Nature. Certain reſults of their natures we conſider as evils. Deſtroy theſe evils, and you annihilate the beings who complain of them. The reciprocal action of the ſolids and fluids conſtitutes life, and the continuation of this action is the natural cauſe of death. Immortality on this earth, therefore, preſuppoſes another ſyſtem; for our planet has no relation to immortal beings. Every animal, and every plant, riſes, by gentle gradations, from an embryo, or gelatinous ſtate, to a certain degree of perfection exactly proportioned to their ſeveral orders. An aſſemblage of all the orders of relative perfection conſtitutes the abſolute perfection of the whole. All the planets of this ſyſtem gravitate toward the ſun and toward each other. Our ſyſtem gravitates toward other ſyſtems, and they to ours. Thus the whole univerſe is linked together by a gradual and almoſt imperceptible chain of exiſtences both animated and inanimated. Were there no other argument in favour of the UNITY of DEITY, this uniformity of deſign, this graduated concatenation of beings, which appears not only from this chapter, but from many other parts of the book, ſeems to be perfectly irrefragable.

In contemplating Man, as at the head of thoſe animals with which we are acquainted, a thought occurred, that no ſentient being, whoſe mental powers were greatly ſuperior, could poſſibly live and be happy in this world. If ſuch a being really exiſted, his miſery would be extreme. With ſenſes more delicate and refined; with perceptions more acute and penetrating; with a taſte ſo exquiſite that the objects around him could by no means gratify it; obliged to feed upon nouriſhment too groſs for his frame; he muſt be born only to be miſerable, and the continuation of his exiſtence would be utterly impoſſible. Even in our preſent condition, the ſameneſs and inſipidity of objects and purſuits, the futility of pleaſure, and the infinite ſources of excruciating pain, are ſupported with great difficulty by cultivated and refined minds. Increaſe our ſenſibilities, continue the ſame objects and ſituation, and no man could bear to live.—Let man, therefore, be contented. His ſtation in the univerſal ſcale of Nature is fixed by Wiſdom. Let him contemplate and admire the works of his Creator; let him fill up his rank with dignity, and conſider every partial evil as a cauſe or an effect of general good.—This is the whole duty of man.

THE END.

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MVSEVM
BRITAN
NICVM

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THE

PHILOSOPHY

OF

NATURAL HISTORY.

BY THE LATE

WILLIAM SMELLIE,

MEMBER OF THE ANTIQUARIAN AND ROYAL
SOCIETIES OF EDINBURGH.

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TO HIS GRACE

THE DUKE OF MONTROSE.

My Lord Duke,

IN giving this Work of my late Father's to the world, I flatter myſelf that, while I diſcharge a duty to the memory of a Parent, I perform, at the ſame time, a not unacceptable ſervice to the Public. The reception with which my Father's former productions of a ſimilar kind were honoured, together with my knowledge of the attention which he paid to the perfecting the preſent work, by the acquiſition of every information which inquiry or reſearch could procure, may fairly inſpire a certain degree of confidence in the favour it may expect to obtain. One circumſtance indeed there is, which naturally creates ſome diffidence in offering this volume to the world, namely, that it is preſented under all the diſadvantages attending a poſthumous work which the death of its Author has deprived of his corrections and reviſal. From this circumſtance, however, it may, perhaps, gain as much on one hand as it loſes on another. While it may be expoſed to the ſeverity of criticiſm, it will conciliate the indulgence of candour, and the favour of humanity. A ſenſe of thoſe amiable qualities in your GRACE emboldens me to uſher it into the world under the protection of your Name. Placed at the head of the *Society of Antiquaries of Scotland*, one of the chief purpoſes of whoſe inſtitution is the extenſion of hiſtorical and literary knowledge in this kingdom; a work calculated for the promotion of Natural Hiſtory and Science cannot be conſidered as foreign to the views of that Society, or to the notice of your GRACE as its Preſident. As Secretary of that Society, I may be allowed to embrace this opportunity of preſenting the volume to your GRACE, and of expreſſing, at the ſame time, the very high eſteem which, in common with my country, I entertain for your GRACE's character, and of that conſideration and reſpect with which I have the honour to be,

MY LORD DUKE,

With the profoundeſt reſpect and eſteem,

Your GRACE's moſt humble ſervant,

ALEX. SMELLIE.

EDIN. NOV. 15.
1798.

PRE-

PREFACE.

IN a Preface to the firſt volume, I gave a ſhort view of the origin, progreſs, and general deſign of this work. With regard to the execution, it becomes me to be ſilent. But I muſt be allowed to expreſs my gratitude for the favourable reception I have obtained from public candour, or, perhaps, public indulgence. This circumſtance, though highly flattering, acts as a depreſſing power on a ſecond attempt. I feel a degree of dread, leſt I ſhould diſappoint expectation, and loſe the ſmall portion of literary reputation I may have acquired. As my plan, however, cannot be completed without another volume, I muſt ſubmit to my fate.

The objects exhibited by nature to our obſervation are numerous, variegated, and connected. To give even a curſory view of the whole, would exceed the powers of any human being. For this reaſon, I have hitherto confined my remarks chiefly to the animal and vegetable kingdoms. In this ſecond and laſt volume, I ſhall obſerve the ſame plan. The field is ſtill extenſive; and I ſhall endeavour to cultivate it, at leaſt, with diligence.

The ſubjects I have ſelected for the preſent publication will not, I hope, be leſs entertaining and inſtructive than thoſe of the former.

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THE

THE PHILOSOPHY OF NATURAL HISTORY.

CHAPTER I.

Of Method.

SECT. I.

Of the utility of Method in every department of Science, and particularly in Natural Hiſtory—Methodical arrangement into tribes and families, both in the animal and vegetable kingdoms, is evidently founded in Nature.

METHOD is the order and diſpoſition of our thoughts, relating to a particular ſubject. It is ſo eſſential to ſcience in general, that the merit of any compoſition is principally eſtimated by the juſtneſs and preciſion with which the authors ideas are arranged.

In Compoſition, whatever be the ſubject, diſtinct ideas are not only neceſſary, but thoſe ideas muſt be diſpoſed in a certain order or method, correſponding to the general deſign of the performance. Neither is method, in this caſe, a matter of choice. It is the reſult of the particular principles and mode of reaſoning adopted by the writer. To enumerate the many advantages ariſing from methodical arrangement in ſcience, is foreign to our purpoſe. Without method, it is impoſſible to reach perſpicuity, the capital object in every compoſition.

In deſcribing a vaſt variety of objects poſſeſſing ſome univerſal and common qualities,—every individual, at the ſame time, having ſome qualities peculiar to itſelf, ſome generic or ſpecific differences which ſerve to diſtinguiſh it from the whole group, and to conſtitute a particular character,—methodical diſtribution is not only uſeful, but indiſpenſably neceſſary.

In ſuch a multifarious ſubject as natural hiſtory, which has for its object the numerous productions of animate and inanimate nature, it was neceſſary to invent ſome mode of generaliſing our ideas. The number of objects is ſo immenſe; the general figure, ſituation and ſtructure of parts in the animal tribes; their manner of living, generation, moral character, or diſpoſition of mind, the artifices employed in defending themſelves and attacking their enemies, in procuring food and providing againſt the inclemencies and viciſſitudes of the different elements, their utility to mankind, and the relations they have to each other; theſe, and many other circumſtances, are ſo various and complicated, that, without a methodical diſtribution into claſſes and genera, although perfectly arbitrary, and though no traces of any connecting principles were diſcoverable in the productions of nature, the mind would inſtantly recoil, and for ever abandon the ſtudy of Natural Hiſtory, as a heap of undigeſted materials which it was impoſſible to bring into a ſcientific form, which conſequently might diſtract and confound, but could never afford any rational entertainment to an intelligent being.

But Nature, however numerous and diverſified in her productions, preſents no ſuch disjointed and incongruous aſſemblages. On the contrary, there is not a ſingle being in the univerſe, whether animate or inanimate, endowed with a ſet of powers and qualities entirely peculiar to itſelf. If ſuch a body really exiſted, and could be recogniſed by our ſenſes, ſo powerful is the impreſſion received from the general concatenation of natural objects, that we could not heſitate a moment in pronouncing it miraculous. The variety of objects is almoſt infinite; but theſe varieties are not effected by large ſtrides, leaving ample room for farther gradations. Their limits, on the contrary, are ſo narrowly, ſo nicely defined, that conſiderable attention, joined to a habit of accurate obſervation, is neceſſary to diſcern them. The general utility of this great and benevolent plan of operation is apparent. Not to mention the other advantages of mutual dependence and relation, this variety and uniformity, thoſe beautiful connections and diſtinctions, allure us to the ſtudy of Nature, afford ſufficient materials for the conſtruction of ſcience, give riſe to all our abſtract ideas, and, of courſe, extend and enlarge our reaſoning faculties.

Every man of ordinary underſtanding, although he has given but little attention to the animals which ſurround him, has been ſo long accuſtomed, not from inſtruction, but obſervation, to arrange them into the four grand natural Claſſes of Quadrupeds, Birds, Fiſhes, and Inſects, that he is unable to recollect either the time or manner in which he acquired the idea of this diſtribution. Without beſtowing a more particular attention, ſuch a perſon cannot be ſuppoſed to inveſtigate thoſe leſs obvious relations which ſerve as a baſis for generic and ſpecific diſtinctions.

But a ſtricter ſcrutiny into the animal creation will ſoon enable us not only to diſcern general analogies and connecting principles, but likewiſe a number of particular and ſtriking relations which characteriſe and conſtitute tribes and families.

So many common qualities occur in the great natural claſs of quadrupeds, that it is almoſt unneceſſary to mention them. They have an equal number of legs; the number of eyes and ears are the ſame; there is an evident ſimilarity in the general figure of their bodies; their ſkins are covered with hair; they are all viviparous, and ſuckle their young; their manner of generating and producing is nearly the ſame. The ſimilarities in their internal ſtructure are not leſs remarkable. They are all furniſhed with lungs to anſwer the purpoſes of reſpiration; their hearts conſiſt of two ventricles and two auricles; their blood is red and warm, &c.

Notwithſtanding the many ſimilarities that take place in the external form and internal ſtructure of the claſs of quadrupeds, the characters and features by which Nature has diſtinguiſhed the different genera or families are ſtill more numerous. Theſe diſtinctions are ſo various, and may be diſcovered in ſo many different parts of the body, in the food, diſpoſitions, and peculiar inſtincts, that they have given riſe to a great diverſity of arrangement adopted by different ſyſtematic writers.

M. de Buffon, indeed, makes the variety of methodical diſtributions an argument againſt ſyſtematic arrangement in general, as implying an uncertainty and deficiency in the natural characters. We ſhall have occaſion afterwards to take notice of the method adopted by this ingenious and eloquent author, and ſhall only, in this place, mention ſome particulars which, we imagine, will be ſufficient to convince the candid inquirer, that methodical diſtribution is not only uſeful in the ſtudy of Natural Hiſtory, but that Nature has actually preſented her productions to us, not in an immenſity of unconnected individuals, but in larger or ſmaller groups, linked together by unambiguous relations. Theſe groups are commonly known by the name of *genera* or *families*, every individual of which ought not only to poſſeſs the general properties of the claſs, but likewiſe a family character and likeneſs. The concurrence of theſe circumſtances is neceſſary to the formation of a *natural genus*, in oppoſition to *artificial* aſſemblages, to which, in ſome caſes, moſt ſyſtematic writers have been obliged to reſort, partly from the want of a ſufficient acquaintance with particular animals, and partly owing to ſome original imperfection in their principles of arrangement.

The cat-kind, the felinum genus of Mr Ray, the felis of Linnæus, comprehends the lion, tigre, panther, leopard, ounce, the cat-a-mountain, the domeſtic cat, and the lynx. The bare inſpection of theſe animals, or their pictures, without knowing any thing of their hiſtory, will at once convince us of their mutual relations, and of the propriety of placing them under one genus. But, after we have learned their hiſtory, and diſcovered the ſimilarity in their diſpoſitions, in their food, manner of ſeizing and devouring their prey, and other circumſtances in their oeconomy, we can no longer heſitate in pronouncing them a natural genus. The horſe, the aſs, and the zebra; the different ſpecies of monkies; the bats; the weſels; the ſquirrels; the different ſpecies of deer; the goat-kind; the ſheep-kind; the ox-kind; the armadillos or tatus; the hare-kind: Theſe, and many others, are in the ſame circumſtances, and have an equal title to be conſidered as natural genera.

We might enumerate ſimilar examples among birds, fiſhes, and inſects; but thoſe who are unacquainted with Natural Hiſtory may believe us when we aſſert, that the ſame diſtinguiſhing features, the ſame family-connections are to be found in the animals belonging to thoſe claſſes as take place among quadrupeds; and the Naturaliſt has no occaſion to be informed of a fact with which he is already ſufficiently acquainted.

We are now fully authoriſed to lay it down as an eſtabliſhed truth, that there is a general ſubordination and concatenation in the animal kingdom, that Nature has actually diſtributed her productions into claſſes, and genera; and conſequently that thoſe ſyſtematic writers who have moſt cloſely followed the order of Nature in their methodical diſtributions are entitled to the higheſt rank in the public eſtimation.

But, although claſſes and genera be evidently founded in nature, a difficulty ſtill remains. In order to facilitate the inveſtigation of animals, naturaliſts have found it neceſſary to make intermediate diviſions between the claſſes and the genera. Theſe diviſions are called *orders*. Even in this article Nature is not altogether deficient. We are already acquainted with many inſtances, in the animal kingdom, of particular relations by which ſeveral genera of the ſame claſs are peculiarly connected. A thorough knowledge of theſe natural relations

tions is all that is neceſſary for the conſtruction of a perfect method. But there is ſuch a variety of circumſtances to be learned, of which we are as yet perfectly ignorant, that the induſtry and experience of many ages will ſtill be neceſſary, if indeed we can ever hope, for the acquiſition of this great deſideratum in natural hiſtory. A ſimilarity in the external figure or internal ſtructure is not enough. The diſpoſitions, manners, inſtincts, œconomy, &c. muſt likewiſe be thoroughly known. We are at preſent far from being ſufficiently acquainted with theſe, and many other important circumſtances, even with regard to ſeveral of our native animals. How then can we expect to ſee a perfect methodical diſtribution? What right have we to cenſure ſyſtematic writers for not arriving at an impoſſible degree of perfection in their method? It is cruel and injurious. To receive with joy the light they communicate, to employ their knowledge and experience in the further advancement of the ſcience, and to grant them the tribute of praiſe in proportion to the merit of their reſpective performances, would be more conſiſtent with that candor and humanity which ought ever to be the inſeparable concomitants of philoſophy.

It is principally in the formation of orders that naturaliſts have ſo widely differed in their ſyſtems. Ignorant of the genuine relations of nature, they have been obliged to have recourſe to artificial diagnoſtics. In the claſs of quadrupeds, the characteriſtic ſigns are taken from the feet, from the teeth, the paps, the parts of generation, &c. There is ſtill a greater diverſity in the orders of birds, fiſhes, and inſects. Particular parts of the body are fixed upon, not becauſe theſe parts are pointed out by Nature as infallible marks of diſtinction or relation, but becauſe a perfect method, in the preſent ſtate of the ſcience, is impoſſible; and any method is preferable to confuſion.

ſion. It is vain, therefore, to diſpute about the propriety or impropriety of the aſſemblages in the orders of a Ray, a Linnæus, a Klein, or a Pennant. Till we acquire a more perfect knowledge of the hiſtory, as well as of the figure of animals, it is of little importance whoſe ſyſtem be adopted, provided the characters be clear, and all the facts that are at preſent known be diſtinctly related. Were every naturaliſt of the ſame ſentiments with regard to this point, many incumbrances with which natural hiſtory is now loaded would be removed; the ſtudent would not be diſtracted and retarded by an infinity of ſynonimes; the ſcience would become more ſimple and intelligible; and, of courſe, its bounds and the number of its votaries would ſoon be greatly augmented. I mean not that all attempts towards the perfection of ſyſtem ſhould be laid aſide; but that, in the preſent imperfect ſtate of the ſcience, it is to be regretted, that ſo much time and genius ſhould be expended in fruitleſs diſputes, and in the augmentation of methods and terms. To add to the number of facts and obſervations, to deſcribe with accuracy and preciſion, to ſeparate fiction from truth, to inveſtigate the œconomy and moral character of animals, and to render their utility to mankind more extenſive: Theſe are objects more worthy of the attention of philoſophers, more agreeable to ingenuous minds, and more correſpondent to the genius of the ſcience.

Nothing further need be ſaid with regard to the utility and defects of method in general. Obſervations of a more particular nature will occur in explaining ſome of the principal methodical arrangements. A ſhort view of the methods invented by ſyſtematic writers will make the reader acquainted with the different and ſucceſſive efforts towards the improvement of method, and give us an opportunity of unfolding more diſtinctly the reaſons by which we have been determined, in the following work, to adopt one in preference to all the reſt.

In moſt authors who have written profeſſedly upon the hiſtory of animals, attempts towards methodical arrangement may be diſcerned. Ariſtotle, Pliny, and Ælian perceived the utility of method. But they ſeem never to have dreamed of the practicability of teaching the ſtudent, by the help of a ſyſtem, partly natural, partly artificial, to inveſtigate the name, and, in many inſtances, even the nature and diſpoſitions of an animal he never ſaw before; or to be able, in a few minutes, to pronounce with certainty, that it had never hitherto been deſcribed by any author. This curious diſcovery was reſerved for a later and more ſcrutinizing age.

SECT. II.

An hiſtorical and characteriſtical Account of the writings and arrangements of the principal ancient and modern Naturaliſts.

§ 1. Analysis of ARISTOTLE's History of Animals, with Remarks.

THERE are few people who have not at leaſt heard of the genius and learning of Ariſtotle. He was a pupil of Plato, and tutor to Alexander the Great. Among many other valuable performances, this great philoſopher compoſed a natural hiſtory of animals; a book, though written between two and three thouſand years ago, which contains a more thorough knowledge of the general relations of animals, with regard to manners, diſpoſitions, inſtincts, external and internal ſtructure, than at this day can be met with in many volumes. The philoſophic habit of his mind led him uniformly to general and expanded views; but his examples, which are conſtantly occurring, at the ſame time that they diſcover a minuteneſs and preciſion in the knowledge of Nature, convey ſolid inſtruction to the reader.

In the firſt book, Ariſtotle gives a general detail of the diſtinctions and analogies ariſing from the ſtructure and ſituation of the parts of animals; their methods of living, their actions and manners; the organs neceſſary to animal life; the various modes of generating; the parts deſtined for motion; the principal genera, or claſſes, as quadrupeds, birds, fiſhes, and inſects, which laſt he ſubdivides into teſtaceous, cruſtaceous, and ſoft *. In the courſe of this inveſtigation, our author diſcovers that a number of animals, as man, the quadrupeds, birds, cetaceous fiſhes, &c. reſpire by means of lungs; and that theſe animals have likewiſe red blood in their veins; whereas inſects have no lungs, and their blood is tranſparent or colourleſs. He further diſcovers, that ſome produce live animals, and others eggs. Hence he deduces the following capital diſtinctions in the animal kingdom, namely, thoſe which have lungs, and thoſe which have no lungs; the ſanguineous and exſangueous; the viviparous and oviparous.

From the 9th to the 24th chapter, which finiſhes the firſt book, we have a conciſe anatomical deſcription of the external and internal parts of the human body.

The ſubject of the 2d, 3d, and 4th books, is a compariſon of the external and internal parts of quadrupeds, ſerpents, birds, fiſhes, and inſects, with regard to the difference of ſtructure in theſe animals compared with each other, and with man, whom the author had particularly deſcribed in the firſt book as a model or ſtandard. He concludes the 4th book with diſſertations on the ſenſes, the voice, ſleeping and watching, and the ſexes of animals.

The 5th and 6th books treat of generation and parturition, the number of young, and other circumſtances relative to this ſubject.

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* Moluſca of Ray, Linnæus, &c.

Book 7th gives a particular account of the circumſtances preceding and following the generation of man, viz. puberty, the menſtrual flux, ſigns of conception, the time of geſtation, the number of young, the milk, the reſemblance of children to their parents, &c.

The firſt fifteen chapters of the 8th book contain a hiſtory of the food and manner of living of the different tribes of animals. From the 15th to the 24th, we have an account of ſuch animals as conceal themſelves at certain ſeaſons of the year, the migration of birds, and what animals renew their age by moulting, or by caſting their ſkin. From the 24th chapter to the end of the book, the author enumerates the diſeaſes of animals, the ſituations and circumſtances that are favourable to health or productive of diſeaſes, and the ſeaſons when they are moſt proper to be uſed for food.

In the firſt chapter of book 9th, the mental differences that take place in males and females are pointed out. The remainder of this book treats of the friendly or hoſtile diſpoſitions of certain animals to one another, and of their characters; it likewiſe contains ſome general deſcriptions and ſpecific diſtinctions.

From this ſhort view of the method and contents of Ariſtotle's hiſtory of animals, the general deſign of the author may be collected. He begun with inveſtigating the manners, diſpoſitions, and ſtructure of individuals. Ariſtotle was enabled to execute this important taſk to more advantage, perhaps, than any other perſon either before or ſince his time. Not to mention the extent of his own genius, Alexander provided him with live animals from every quarter of the then known world. Theſe were ſupported by the munificence of a monarch who merited the epithet of Great, not for the boundleſs ambition of his heart, not for the ſlaughter of millions of his own ſpecies, but for the protection and encouragement he afforded to the greater Ariſtotle.

After ſpending much time and labour in inveſtigating the characters and diſpoſitions of animals; after making repeated experiments in order to diſcover the ſecret ſprings of their actions, the extent of their capacities, their affections and averſions; after ſatisfying himſelf with regard to theſe and many other intereſting articles, Ariſtotle's next object was, how to digeſt thoſe materials ſo as beſt to promote the ſcience of nature. To give a particular deſcription and hiſtory of every individual neither correſponded with the genius of the author, nor with the ſtate of the ſcience at that time. To inveſtigate the relations and differences which ſerve to connect and diſtinguiſh the various tribes of animals, was the capital object of the learned author. Like the great Bacon, inſtead of retailing idle fictions, or facts founded only upon ignorance and credulity, Ariſtotle perceived the neceſſity of aſcertaining the genuine principles of the ſcience by actual experiments. Some idea may be formed of the number of thoſe experiments, and the judgment with which they were conducted, by the extenſive and accurate concluſions the author has drawn from them. Whoever reads Ariſtotle's hiſtory of animals with the ſame view with which he reads ſome modern authors will be greatly diſappointed. Trifling anecdotes, marvellous feats of ſtrength, ferocity, or cunning, addreſſed to the imagination in the language of declamation, are not to be expected in the works of an Ariſtotle.

His chief object was to reduce into a ſcientific form a branch of natural knowledge, which had hitherto conſiſted only of a chaos of detached, uncertain, and often fabulous narrations and deſcriptions. The happy circumſtances in which he was placed, joined to the uncommon abilities with which this extraordinary perſon was endowed, enabled him to unfold the principles of natural hiſtory with ſuch amazing ſucceſs, that, to this day, no ſyſtem has been attempted, the principles of which have not evidently been derived from Ariſtotle. Analogies and diſtinctions are not only drawn from magnitude, figure, faculties and diſpoſitions of mind, but from the inſtruments of motion, the teeth, the eyes, the genitals, and, in a word, from every external and internal part of the body.

Having ſaid ſo much on what appears to be the nature and deſign of Ariſtotle's hiſtory of animals, it now becomes neceſſary to diſcloſe the principal intention of being ſo particular.

The eloquent M. de Buffon, and his learned and induſtrious friend M. Daubenton, declared enemies to methodical arrangement themſelves, betray a ſtrong inclination to preſs this illuſtrious ancient into their ſervice. They allege, that Ariſtotle, ſo far from having a deſign to eſtabliſh the *principles of ſyſtem*, ſhows a ſovereign contempt for methodical diſtribution, not only by the plan he has followed, but in different parts of the work itſelf; and yet, by way of compliment to the author, they ſay, "that it is neceſſary to go back "to the days of Ariſtotle for the general *principles of the diviſion of* "*animals* *." After mentioning the ſources from which Ariſtotle, in his firſt book, derives the diſtinguiſhing characteriſtics of different animals, theſe gentlemen inſiſt, that the author never meant them to be the foundation of a modern nomenclature or ſyſtem, ſimilar to thoſe of Ray or Linnaeus [*].

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* Hiſt. Nat. par Buffon, vol. 4. p. 142.

With regard to this we are perfectly agreed, but for a very different reaſon. Ariſtotle ſaw the perplexed ſtate of the ſcience, or rather perceived that the natural hiſtory of animals had not hitherto been reduced to a ſcientific form. He therefore applied the whole force of his mind towards the inveſtigation of general principles, to ſerve as a baſis for ſyſtem, and as a model for future writers. But, after the labour of many years, and encountering numberleſs difficulties, even making every allowance for the extent of his capacity and foreſight, it can hardly be ſuppoſed that Ariſtotle could ever conceive the poſſibility of a ſyſtem ſo perfect as either that of Ray or Linnaeus.

Buffon and Daubenton further allege, that Ariſtotle was too well acquainted with the nature of animals, to attempt a regular diviſion of them into claſſes, orders, genera, and ſpecies; that he only uſed generic terms in compliance with the ideas of the vulgar, who uniformly give the ſame name to objects endowed with ſimilar qualities; but that he formally proſcribes all ſubdiviſions of the genus, as being partly forced, partly impoſſible; and becauſe, in forming the different branches of thoſe ſubdiviſions, objects are ſeparated and diſperſed which ought always to be placed under one point of view: Beſides, that, in ſubdividing the genus, we are obliged to uſe negative characters: That Ariſtotle rejects negative characters, becauſe no diſtinctions or relations can be eſtabliſhed upon an idea of privation, and becauſe a thing which does not exiſt cannot be divided into ſpecies [†].

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[*] Hiſt. Nat. par Buffon, vol. 4. p. 143.

[†] Ibid. vol. 4. p. 143. et ſeq.

This repreſentation of the ſentiments of Ariſtotle concerning methodical arrangement induced me to peruſe his hiſtory of animals with more than ordinary attention; and, if I am not greatly miſtaken, I have diſcovered the only reaſon which could induce the author to drop a few expreſſions which, at firſt view, ſeem to juſtify Buffon and Daubenton's opinion.

Whoever reads the book will ſoon perceive that the word *genus* is often uſed in the ſame ſenſe as *claſs* or *order* among the moderns; and ſometimes it is limited to the ſame idea that *we* affix to genus *. This circumſtance frequently gives riſe to ambiguity.

Our author, as formerly obſerved, never intended to give a particular deſcription and hiſtory of every ſpecies. Man being the principal and beſt known animal in the creation, Ariſtotle takes him as a ſtandard, and deſcribes minutely his whole frame and movements. In deſcribing the inferior tribes of animals, he ſeldom deſcends to minutiae, but keeps chiefly in view their relations and diſcrepancies. Ariſtotle's book, therefore, is not a natural hiſtory of animals in the modern ſenſe of theſe words. It conſiſts only of philoſophical diſſertations on the general ſtructure, manners, and diſpoſitions of animated beings. If any perſon wiſhes to learn Ariſtotle's account of the lion, tiger, horſe, elephant, or any other animal,

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* Sunt autem genera ſumma quaedam, quibus animalia diſtinguuntur. Sunt vero haec: *Unum* avium; alterum piſcium; tertium cetorum; quae omnia conſtant ſanguine. Eſt et *aliud* eorum genus, quae teſta conteguntur, quod oſtream appellatur. Item *aliud*, quod molliore teſta operitur; caeterum nomine uno comprehenſum eſt; quales locuſtae et cancrorum genera quaedam, atque gammarorum. Praeterea aliud molluſcorum; cujuſmodi lolligines, et lollii, et ſaepiae. Poſtremo, inſectorum quoque *genus* eſt, quae omnia carent ſanguine.—*Ariſt. Hiſt. Animal. edit. Scalliger. lib.* 1. *cap.* 7. *et alibi paſſim.*

mal, he muſt peruſe the whole work before he can collect every thing the author has ſaid concerning them. His facts and obſervations are numerous; but, with regard to particular animals, theſe are not to be found in one place, nor in treating of an individual ſubject in the form of a continued hiſtory. On the contrary, his facts are always employed to ſupport the principles which he at the time is endeavouring to eſtabliſh.

To an author compoſing a book upon Ariſtotle's plan, therefore, a ſcrupulous ſubdiviſion of the different claſſes or genera could have anſwered no uſeful purpoſe. In eſtabliſhing or inveſtigating general principles, it is neceſſary to have a free and unlimited range through the whole circle of nature. Accordingly Ariſtotle, in treating of generation, the ſenſes, the inſtruments of motion, &c. inſtead of taking an individual for his ſubject, gives all the varieties that can be collected from the whole animal creation: And this conduct he uniformly purſues, whatever be the ſubject he is handling.

Such being the plan of our author, it ſurely cannot ſurpriſe any perſon to ſee him occaſionally obſerving, "that as many animals "are poſſeſſed of ſome common qualities, it is unneceſſary to treat "of theſe qualities as ſeparately exiſting in different ſubjects."

It is an obſervation as old as Pliny, that there is not any book from which a man may not learn ſomething: And it may likewiſe be obſerved, that, when a man reads with a view to ſupport a preconceived opinion, there is hardly any book in which he will not at leaſt imagine that he has found ſomething to his purpoſe. We will venture to affirm, that no man, who had not previouſly determined to condemn the methodical diſtribution of animals, could have ever

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diſcovered that Ariſtotle had the ſmalleſt inclination to be of the ſame opinion. Inſtead of endeavouring to learn the general deſign of the book before us, were we, in imitation of Buffon and Daubenton, to pick out all the paſſages that actually favour methodical arrangement, this chapter would be enormouſly ſwelled with quotations.

§ 2. OF PLINY, THE ELDER.

AFTER reading Ariſtotle, it is natural to expect that every ſucceeding writer upon the ſubject of animals would have either adopted his principles or endeavoured to improve them. But, on peruſing the works of the ſucceſſors of that great philoſopher, this expectation is by no means gratified. Ariſtotle demonſtrated the neceſſity of method and of accurate deſcription. But, inſtead of following his example, the very idea of method, whether natural or artificial, ſeems to have been almoſt entirely loſt for many centuries. Had the ancients been more explicit in their deſcriptions of natural bodies, their inattention to method might eaſily have been pardoned. But, with regard to this moſt eſſential article, they are ſo exceedingly defective, that it is often impoſſible to diſcover the ſubject of which they are treating. They ſuppoſe the reader to know every ſubſtance merely by the name they chuſe to give it. If any character by which the body may be diſtinguiſhed appears in their writings, it ſeems to eſcape from the author as it were by accident. Even when a deſcription is attempted, the permanent and eſſential characters are generally miſſed; and nothing but accidental and mutable characters, or, which is ſtill worſe, characters that equally belong to other ſubſtances, are exhibited. Nay, in deſcribing ſpecies, the characters of the genus itſelf are often totally omitted *. Were it difficult to demonſtrate the utility of methodical diſtribution by arguments of a different nature, it would be ſufficient to refer the oppoſers of method to the ancient writers of natural hiſtory, to ſhew how much confuſion and ambiguity the want of ſuch diſtribution occaſions.

But, although the ancient naturaliſts were not ſo attentive to method and accuracy of deſcription as could be wiſhed, we muſt not therefore ſuppoſe them to be deſtitute of merit. On the contrary, their writings are diſtinguiſhed by a grandeur and elevation of ſentiment which few moderns have been able to reach. Deſpiſing every thing that appears to be trifling or inſignificant, they exalt our ideas of nature, and are particularly ſollicitous to ſhew that all her productions anſwer ſome uſeful purpoſe to mankind.

The want of method and preciſion of deſcription is peculiarly to be regretted in the works of the learned and laborious Pliny. His genius was too comprehenſive to be limited to any branch of natural hiſtory. His ideas of this ſubject were not confined to animals, vegetables, and minerals, but extended to every production of Nature exhibited either in the heavens or the earth. Agreeably to theſe ideas, Pliny's Hiſtory of Nature, beſides a hiſtory of the animal, vegetable, and mineral kingdoms, comprehends an abridgement of all that the ancients knew in geography, aſtronomy, botany, agriculture, gardening, medicine, the liberal arts, &c. His ſtyle is conciſe, nervous, and elevated. His knowledge is profound, and his method of reaſoning clear and philoſophical. But, as it is foreign to our preſent deſign, to give an account of Pliny's manner of

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* Vid. Plin. Hiſt. Nat. cap. 8. et alibi paſſim.

of treating every ſubject, we ſhall confine ourſelves to his hiſtory of animals.

Pliny, in this part of his work, begins with man. He does not, however, like Ariſtotle, give a deſcription of the ſtructure of the human body. His chief objects are the external figure of men, the diſpoſitions, manners, and cuſtoms of different nations. Here our author diſcovers an extenſive erudition, and a deep knowledge of human nature.

A ſtrange mixture of character, however, appears in moſt parts of Pliny's writings. A mind ſtored with every ſpecies of literature, a refined taſte, a ſceptical ſcrutinizing temper, combined with a conſiderable portion of ſuperſtition and credulity. He gravely tells us of a certain northern nation, called Arimaſpi, who have but one eye in the middle of their foreheads; of a country inhabited by wild men with their feet behind their heels; of a nation of hermaphrodites mutually impregnating each other; of a people with a couple of pupils in each eye; of a ſpecies of men with dogs heads; of another ſpecies with eyes in their ſhoulders; of a third ſpecies who have no mouths, and are nouriſhed ſolely by ſmelling, &c. A number of extravagancies of this kind are to be found in the ſecond chapter of the 7th book. Pliny indeed generally quotes his authorities for ſuch abſurdities; but, from his manner of writing, and his arguments in favour of this ſpecies of credulity contained in the firſt chapter of the ſame book, it is plain, that he firmly believed, or at leaſt means that his readers ſhould believe, moſt of thoſe ridiculous chimeras.

After mankind, Pliny treats of land-animals, as diſtinguiſhed from aquatics. In this part of his ſubject he obſerves not the leaſt veſtige of order. It is a mere jumble of quadrupeds, ſerpents, frogs, lizards, &c. Next follow the aquatic animals; then the birds; and, laſtly, the inſects. The order in which theſe laſt claſſes are treated is exactly of a piece with that in the firſt claſs. Beſides, he even mixes and confounds the very order which he ſeems to follow *.

Upon the whole, notwithſtanding Pliny's deficiencies with regard to method and deſcription, his hiſtory contains the greateſt part of the natural knowledge of the ancients, compiled indeed from other authors, but managed with ſuch taſte and addreſs, that the whole has the appearance of an original compoſition.

§ 3. OF ÆLIAN.

THIS author was a Roman, and lived under the Emperor Adrian. He was, however, ſo fond of the learning of the Greeks, that, in his compoſitions, he preferred their language to his own. Though he has written upon other ſubjects, he acknowledges, that his genius had a peculiar bias towards natural hiſtory. He therefore choſe that ſubject for his principal work, which he entitled, *Of the Nature of Animals*.

The work is divided into ſeventeen books: Theſe diviſions do not reſult from the nature of the compoſition, but ſeem to have been made merely for the conveniency of the reader. Ariſtotle, as a natural hiſtorian, aſtoniſhes us with extent of knowledge and depth of penetration: The amiable Ælian addreſſes himſelf, in the gentleſt manner, to our reaſon and imagination, warms our hearts with the love of virtue, and excites a ſovereign contempt of every action or ſentiment beneath the dignity of our nature.

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* Vid. Plin. Hiſt. Nat. lib. 8. 9. 10. 11.

Ælian's favourite aim was, to rouſe the ſentiments and enforce the practice of genuine morality. Arguments drawn from the beauty of virtue and the deformity of vice were as common and as ineffectual in his days as in ours. He therefore laid hold of another and more powerful principle of human nature. Being well acquainted with the manners and diſpoſitions of the animal creation, inſtead of painting human heroes and human miſcreants, Ælian ſtimulates our pride by the generoſity, friendſhip, gratitude, courage, meekneſs, reſignation, modeſty, parental affection, and temperance, exhibited in the characters of particular animals; and excites our averſion by the illiberality, ſelfiſhneſs, ingratitude, puſillanimity, ferocity, impatience, obſcenity, unnaturality and gluttony, diſplayed in the diſpoſitions of others.

In compoſing a book with this view, we cannot ſuppoſe that the author would find it neceſſary to cramp himſelf with a ſtrict connection in the different parts of his work, far leſs to write in the form of a ſyſtem. Ælian's whole book, on the contrary, conſiſts of unconnected anecdotes concerning animals, either derived from his own experience or collected from the writings of others. In the 37th chapter of the eleventh book, however, he has occaſionally collected Ariſtotle's principles of the diviſion of animals, and reduced them into ſuch order as would make no contemptible figure in a modern ſynopſis. Ariſtotle's chief attention was directed to the external and internal ſtructure of animals, in order to aſcertain the principles and facilitate the ſtudy of natural hiſtory. Ælian ſteers an oppoſite courſe. He ſeldom or never takes notice of external forms or qualities, but confines himſelf entirely to mental character and diſpoſitions. It requires no depth of penetration to diſcover many anecdotes which have the air of fable and credulity: But a reader endowed with a moderate ſhare of good nature will find little difficulty in pardoning faults of this kind. The author has enriched his work with a multitude of genuine and unconteſted facts. If he ſometimes relates ſtories that require more faith than his reader is poſſeſſed of, he generally either quotes his authority, or gives a hint that he does not believe them himſelf. Beſides, in many ſtories of this kind, it is eaſy to perceive that the moral is Ælian's principal object.

§ 4. OF OPPIAN.

OPPIAN was a native of Cilicia, and flouriſhed under the Emperors Severus and Antoninus Caracalla. He compoſed two excellent poems in the Greek language, and preſented them to Antoninus, who was ſo delighted with them that he recalled Ageſilaus, Oppian's father, from baniſhment, and farther rewarded the author with a piece of gold for every verſe. The ſubjects of thoſe poems are fiſhing and hunting. Though Oppian died in his 30th year, his poems diſcover a brilliancy of genius, a correct taſte, a maturity of judgment, and a compleat knowledge of ancient learning. Natural hiſtory, however, ſeems to have been his favourite ſtudy. In his poem on fiſhing, a vaſt variety of fiſhes are deſcribed with ſurpriſing accuracy and minuteneſs; and, in the poem upon hunting, the principal quadrupeds are painted in lively colours. Oppian does not, however, confine himſelf to deſcription alone: He frequently gives a pretty compleat hiſtory of the manners, diſpoſitions, and œconomy of the different animals introduced in his poems. Although, from the nature of the performance, we cannot expect that the author ſhould write in a ſyſtematic ſtrain; yet he diſcovers an intimate acquaintance with the principles upon which ſyſtem is founded. It is remarkable, that Oppian, though poſſeſſed of a warm poetical fancy, has rejected moſt ſtories that favour of fiction and credulity.

§ 5. OF GESNER.

CONRAD. GESNER, a phyſician at Turin, publiſhed a natural hiſtory of animals in the year 1551-58, conſiſting of four large volumes in folio. The ſubdiviſions of his claſſes are entirely regulated by the letters of the alphabet, and conſequently deſerve no further notice. He indeed makes an apology for this conduct. He allows that methodical diſtribution is more philoſophical; but he prefers the alphabetical arrangement on account of his numerous philoſophical obſervations, which he conſiders as the moſt valuable part of his work. As this author has collected every thing that had been ſaid upon animals by ancients and moderns, by poets, philoſophers, phyſicians, ſhepherds, grammarians, &c. in all countries and languages, his work may be of uſe to ſome readers; but his prolixity is inſufferable, particularly his philological diſcuſſions. In a word, Geſner's natural hiſtory may be conſidered as a rude quarry from which ſome valuable ſtones may be dug; but the labour of removing the rubbiſh overbalances their intrinſic worth. In the hiſtorical part, there are many valuable anecdotes, blended with a variety of fabulous impertinences.

§ 6. OF WOTTON.

IN the hiſtory of particular ſciences, there appears, at certain periods, a ſtrange inattention to facts and principles previouſly diſcovered. Ariſtotle, above two thouſand years ago, unfolded the principles of natural hiſtory in the moſt ſimple and perſpicuous manner. But the ſpirit and deſign of his book were either never fully underſtood or unaccountably neglected by all the ſubſequent writers upon this ſubject, till towards the middle of the 16th century.

At this period, there aroſe, in different parts of Europe, ſeveral learned and ingenious naturaliſts, who perceived that all animated beings were connected by certain mutual relations; that theſe relations had been too much neglected by preceding authors: and that this inattention to the order and concatenation of objects was the principal reaſon why the knowledge of nature was ſo little cultivated, and ſo difficult to be attained. Methodical arrangement, therefore, became a capital object of attention; and moſt writers after this period were more or leſs ſucceſsful in their arrangements, according to the acuteneſs of their obſervation, and the extent of their capacities.

EDWARD WOTTON, a phyſician at Oxford, compoſed a volume upon the diſtinguiſhing characteriſtics of animals, which was publiſhed at Paris in the year 1552, and inſcribed to Edward VI. King of England *.

He begins with an enumeration of the peculiar qualities by which

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* Edwardi Wottoni Oxonienſis de differentiis animalium libri decem. Lutetiæ Pariſiorum 1552.

the various ſpecies of animals are diſtinguiſhable from each other: Theſe diſtinctions are derived from a multiplicity of circumſtances; from the ſenſes, external and internal parts, the food, affections and averſions, manners, colour, actions, inſtruments of motion, the elements in which they live, their modes of generating and producing, &c. Having executed this part of the work with great judgment and learning, Dr Wotton proceeds to give a more particular account of the genera and ſpecies, which he claſſes in the following manner:

I. Sanguineous, or animals with red blood.

II. Exangueous, or animals with tranſparent or colourleſs blood.

The firſt claſs is divided into five orders, viz. 1. Man, as being the head of the animal creation. 2. Viviparous quadrupeds. 3. Oviparous quadrupeds and ſerpents. 4. Birds. 5. Fiſhes.

The ſecond claſs he divides into two orders, viz. 1. Inſects. 2. Exangueous aquatic animals.

The viviparous quadrupeds are ſubdivided into, 1. Digitated, or toed, as apes, dogs, &c. 2. Cloven-hoofed, as the cow, the ſheep, &c. 3. Whole-hoofed, as the horſe, the aſs, &c. Under oviparous quadrupeds are comprehended frogs, lizards, &c. Serpents are added on account of their ſimilarity.

The birds are ſubdivided into, 1. Fidipedes, or ſuch as have unconnected toes, as the gallinaceous kind, &c. 2. Carnivorous, as the eagles, vultures, &c. 3. Aquatic birds, which are again diſtinguiſhed into ſuch as frequent the ſhores and marſhy places, as the cranes, the ſnipes, &c. and ſuch as are web-footed, as ducks, &c.

The fiſhes are ſubdivided into, 1. Cartilaginous, plain, oblong, and long. 2. Saxatiles, or thoſe which frequent ſtony places. 3. Cetaceous, or the whale-kind.

The inſects are ſubdivided into, 1. Such as build neſts or combs, as the bee, waſp, &c. 2. Such as are furniſhed with a proboſcis. 3. Such as have their wings incloſed in a cruſtaceous ſheath, as beetles, &c. 4. Caterpillars.—To the arrangement of the inſects, our author ſeems to have paid leſs attention than to that of the other orders of animals; for he has not availed himſelf of many excellent diſtinctions which he had pointed out in the beginning of his ninth book.

The exangueous aquatic animals are ſubdivided into, 1. Soft, as the cuttle-fiſh, &c. 2. Cruſtaceous, as lobſters, crabs, &c. 3. Teſtaceous, or ſhell-animals. 4. Zoophyta, as the ſpongia, &c.

Dr Wotton's deſcriptions are not only conciſe and elegant, but the œconomy and diſpoſitions of the different animals are painted in a lively and entertaining manner. His taſte in compoſition is chaſte and unaffected. Though well acquainted with the writings of the ancients, he does not encroach on the patience of his readers, or augment the ſize of his book, by unneceſſary and tedious quotations.

§ 7. Of BELONIUS.

Petrus Belonius publiſhed a volume de Aquatilibus, at Paris, in the year 1552. Under aquatic animals, Belonius comprehends the cetaceous fiſhes, the hippopotamus, the otter, the water-rat, and other amphibious animals. He divides the whole into two orders, viz. the Sanguineous and Exangueous. The ſanguineous he ſubdivides into viviparous, as the whale, the dolphin, the hippopotamus, &c. Oviparous, as the crocodile, &c. Cartilaginous, which laſt he again ſubdivides into viviparous and oviparous, ſpinous, broad, and oblong fiſhes; fiſhes which reſemble ſerpents; and what he calls the leſſer ſpinous, ſcaly fiſhes, which he diſtributes into pelagii, or fiſhes found only at great diſtances from the ſhores; littorales, or thoſe which frequent the ſhores; ſaxatiles, or thoſe which frequent rocks and ſtony places; and, laſtly, the amnici and lacuſtres, or thoſe found in rivers and lakes.

In the 1555, Belonius, or Belon of Maine, publiſhed another volume upon birds, which he arranges in the following manner:

Order I. Rapacious birds, both diurnal and nocturnal, as eagles, vultures, owls. II. Water-fowl, or thoſe which are web-footed, and ſwim in water, as the ſwan, pelican, ducks, &c. III. Birds which frequent banks of rivers, and marſhy places, and are not web-footed, as the crane, the heron, &c. IV. Land-fowl, which build their neſts upon the ground, as partridges, &c. V. Birds which frequent almoſt every place, and which live upon different kinds of food, as crows, pies, parrots, woodpeckers, &c VI. Small birds which build their neſts in hedges and buſhes: Theſe are ſubdivided into inſectivorous, granivorous, and ſuch as feed indifferently either upon inſects or grain.

The author diſcovers an extenſive knowledge of his ſubject, and a tolerable taſte in compoſition, which is more conciſe, leſs embarraſſed with quotations, and the ideas are clearer and better arranged than in the writings of moſt of his cotemporaries.

§ 8. Of RONDELETIUS.

In the year 1554, Rondeletius, a profeſſor of medicine at Montpelier, publiſhed a work, De Piſcibus. The firſt four books are entirely occupied with the diſtinguiſhing characters of fiſhes. Thoſe characters are taken from the external and internal figure of the parts; from the manners and diſpoſitions; from the food, the places frequented by different kinds, and many other circumſtances. He diſtributes all fiſhes into two orders, viz. I. Sanguineous. II. Exangueous. The fiſhes comprehended under the firſt order are ſubdivided into, 1. Broad, compreſſed, ſcaly fiſhes, as the aurata, ſparus, &c. 2. Saxatiles. 3. Small fiſhes. 4. What the author calls the lizard-kind, as the acus, &c. 5. Round, uncompreſſed, ſcaly fiſhes, as the lupus, aſellus, &c. 6. Fiſhes ſtill rounder than the former, of a reddiſh colour, and having a thick head, as the mullet, milvus, &c. 7. Plain fiſhes, not cartilaginous, as the ſoal, &c. 8. Plain cartilaginous fiſhes, as the raiæ, &c. 9. Long fiſhes, as the conger, &c. 10. Foreign fiſhes, as the orbs, &c. 11. Cetaceous fiſhes, as the whale, &c.—The ſecond order, viz. the exangueous, he divides into, 1. Teſtaceous, or ſhell-fiſh, which conſiſt either of one or a double ſhell. 2. Turbinata and cochleæ. 3. Inſects and zoophytes.

Rondeletius was ſo fully convinced of the neceſſity of methodical arrangement, that he frequently mentions the impoſſibility of diſtinguiſhing one object from another, without having recourſe to the various marks by which the productions of Nature are characteriſed [*]. The firſt fiſh he deſcribes is the aurata; but he anxiouſly guards his reader from imagining that he does ſo becauſe the name of the animal begins with the letter A [†]. Rondeletius deſcribes with accuracy and fidelity: His taſte in compoſition is ſtill more chaſte than that of Belonius.

§ 9. Of SALVIANUS.

Hippolytus Salvianus, a profeſſor of medicine at Rome, publiſhed, in the year 1557, a large folio volume, entitled, Aquatilium Animalium Hiſtoria. This book contains the deſcription and hiſtory of about 100 fiſhes, with figures drawn from the life, and engraved on copperplate with ſurpriſing taſte and elegance. As the author confined himſelf entirely to ſuch fiſhes as he had ſeen and examined, it was unneceſſary for him to diſcover any ſolicitude about ſyſtematic arrangement. His deſcriptions are minute and accurate; but the reader is frequently embarraſſed and interrupted with uſeleſs quotations from the antients.

§ 10.

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[*] Quid enim eſſet aliud inter nos quam chaos quoddam et rerum omnium confuſa congeries, niſi forma, colore, aliiſque hujuſmodi internoſcerentur? Quo pacto lapides, herbæ, piſces, a ſeſe diſcernerentur, ſi per omnia ſimiles ſibi-ipſis eſſent? Ne illa quidem linguarum confuſio in Babel tantum unquam negotii exhibuit, quantum illa rerum omnium ſimilitudo exhibuiſſet! Rondelet. de piſc. lib. 2. p. 31.

[†] Nolim autem quemquam exiſtimare, ideo nos Auratam primum depingere, quod ab A litera incipiat. Hunc enim ordinem per literarum elementa, non minus in piſcium quam in herbarum deſcriptionibus, vitioſum eſſe exiſtimamus; et hunc ſecutos jure quidem a Dioſcoride reprehenſos fuiſſe. Rondelet. de piſc. lib. 5. p. 113.

§ 10. Of ALDROVANDUS.

Ulysses Aldrovandus practiſed as a phyſician at Bononia in Italy. He wrote a ſyſtem of natural hiſtory conſiſting of 12 folio volumes. Several of them were publiſhed after his death, which happened about the end of the 16th century. This voluminous author was ſo ſenſible of the abſurdity of attempting to communicate ſcience without method, that he expreſſes a degree of indignation againſt many of his predeceſſors, who, for want of genius to diſcover even the moſt obvious relations of nature, had recourſe to an alphabetical arrangement *.

Aldrovandus diſtributes the animal kingdom into ſix claſſes, viz. I. Quadrupeds. II. Serpents. III. Birds. IV. Fiſhes. V. Inſects. VI. Exangueous animals, or animals with colourleſs blood.

I. Quadrupeds.

These he ſubdivides into three orders. 1. Whole-hoofed. 2. Cloven-hoofed. 3. Digitated or toed.

In the firſt order, viz. the whole-hoofed animals, he begins with the horſe, becauſe he is the moſt uſeful to mankind; then follow the aſs, the mule, the unicorn, and the elephant.

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* Qui alphabeticum in ſcientiis ordinem ſecuti ſunt, ut Paulus Ægineta, Avicenna, &c. ſemper mihi diſplicuerunt, quod, rerum ſpecies commiſcentes, quæ ſimilis naturæ ſunt, ideoque conjungenda, diſtrahant; quæ vero plurimum a ſe mutuo diſcrepant, ideoque diſtinguenda, contra connectant, Naturæ ordinem turbant, ſcientiorumque methodum omnem invertant, ac confundant. Aldrov. Ornithol. p. 7.

The ſecond order conſiſts of the cow, bull, and ox; the urus, bonaſus, buffalo, ſheep-kind, goat-kind, rhinoceros, camel, camelopard, and ſow.

The third order is ſubdivided into viviparous and oviparous. The viviparous are again ſubdivided into feræ, or ſavage animals; ſemiferæ, or wild animals; and domeſtic animals. Under feræ are arranged, the lion, lynx, tiger, bear, wolf, &c. The ſemiferæ comprehend the fox, ape-kind, caſtor, &c. And under domeſtic are contained the dog and cat.—The oviparous, as the frog, the toad, lizards, &c. are placed laſt becauſe of their ſtupidity and want of dignity.

II. Serpents.

They are divided into two orders: 1. Thoſe who have no feet. 2. Thoſe who have feet.

III. Birds.

These are arranged into three orders: 1. Rapacious. 2. Granivorous. 3. Aquatic birds, and thoſe who frequent the ſhores.

The rapacious, or birds with crooked claws, and generally carnivorous, he ſubdivides into, 1. Diurnal, who ſeize their prey in the day, as the eagles, hawks, and falcons. And, 2. Nocturnal, who prey during the night, as the owl, the bat, &c. Here he ſubjoins the parrot tribe, on account of the general ſtructure of their bodies, and becauſe they eat fleſh when in a domeſtic ſtate.

The granivorous comprehends the peacock, turkey, pheaſants, and partridges. Here he makes two ſubdiviſions: 1. The baccivorous, or berry-eaters, as the thruſh, the ſtarling, &c. 2. The vermivorous, or inſect-eaters, as the ſwallows, motacilla, &c. He ſubjoins a ſection upon ſinging birds, as the nightingale, lark, goldfinch, &c.

The aquatic birds are divided into, 1. Web-footed, as the ſwan, pelican, ducks, &c. 2. Littoral, or thoſe which frequent ſhores, banks of rivers, and marſhy places, as the ſtork, the cranes, the woodcock, &c.

IV. FISHES.

Theſe our author arranges into ſix orders: 1. Saxatiles, or thoſe which frequent ſtony places. 2. Littorales, or thoſe found near the coaſts. 3. Pelagii, or ſuch as are only found at great diſtances from the ſhores. 4. Thoſe which both frequent the ſea and rivers. 5. River-fiſh. 6. Whales, or cetaceous fiſhes.

V. INSECTS.

This claſs conſiſts of two orders: I. Terreſtrial. II. Aquatic. The firſt order is divided into inſects with feet, and inſects without feet. The inſects furniſhed with feet are again ſubdivided into, 1. Thoſe with, and thoſe without, wings. 2. Inſects having elytra, or whoſe wings are ſheathed in a cruſtaceous covering, as the beetles, &c. and inſects which have no elytra. 3. Naked-winged inſects have either (1.) four membranaceous wings, as the bee, the waſp, &c. or, (2.) four farinaceous wings, as the butterflies, &c. 4. Two-winged inſects, as the domeſtic fly, &c. Inſects without wings are divided into, 1. Thoſe which have few feet, i. e. from 6 to 14, as the ant, the ſcorpion, &c. 2. Thoſe which have many feet, as the millipes, &c.—There is no ſubdiviſion of the inſects that want feet, as the earth worm, &c.

The ſecond order, or aquatic inſects, is likewiſe divided into thoſe which have feet; as the muſca fluviatilis, and thoſe which have no feet, as the leech, &c.

VI. EXANGUEOUS.

Theſe are divided into, 1. Soft, as the cuttle-fiſh, &c. 2. Cruſtaceous, as lobſters, crabs, &c. 3. Teſtaceous, or ſhell-fiſh. 4. Zoophyta, as the pulmo marinus, &c.

This diſtribution of animals, though inaccurate in many reſpects, is by no means contemptible. Aldrovandus's principles of arrangement are numerous; but they are frequently unphiloſophical. For example, in the claſs of fiſhes, the principle of arrangement, inſtead of being derived from qualities peculiar to the animals themſelves, is taken ſolely from the places which they moſt commonly frequent. What he ſometimes calls dignity, ſometimes utility, ſometimes genius, or mental abilities, is another principle of diviſion which he attempts to follow through all his claſſes. This often leads him into an unneceſſary train of ridiculous argument, in ſettling the precedency of animals, whoſe hiſtory is ſtill too little known to admit of ſuch reaſoning.

With regard to the execution of the work itſelf; the deſcriptions are in general good. The hiſtorical part is frequently debaſed with fable and credulity. The manner of writing is deeply marked with the falſe taſte of the age in which the author lived; and the whole is enormouſly ſwelled with long quotations from poets, grammarians, and commentators, and other ſuperfluous matter.

§ 11. Of JONSTON.

Dr John Jonſton, a phyſician at Leſzno in Poland, publiſhed a ſyſtem of Natural Hiſtory at Amſterdam, in the year 1657. This author's chief aim was, to give an abridgement of the voluminous works of Geſner and Aldrovandus: He has likewiſe added the American animals from Margraaf and Piſo. He digeſts the whole into five general claſſes. I. Quadrupeds. II. Birds. III. Fiſhes. IV. Inſects. V. Serpents. He firſt publiſhed the fiſhes, next the birds, then the quadrupeds, and, laſtly, the inſects and ſerpents.

The quadrupeds are arranged into the following orders: 1. Whole-hoofed. 2. Cloven-hoofed; which laſt are ſubdivided into ruminating animals with, and without horns, and ſuch as do not ruminate. 3. Digitated viviparous animals, which are either terreſtrial or aquatic; and digitated oviparous animals, which are either covered with ſhells, or have no ſhells.

There are two orders of birds: 1. Land-fowls. 2. Water-fowls. The firſt order is ſubdivided into carnivorous; granivorous which do not ſing; granivorous ſinging birds; inſectivorous that do not ſing; and inſectivorous ſinging birds. The ſecond order is ſubdivided into, web-footed aquatic birds, which feed upon fiſhes; web-footed herbivorous birds ; carnivorous, inſectivorous, and herbivorous aquatic birds, with divided toes.

The claſs of fiſhes is ſubdivided into the following orders : 1. Pelagii. 2. Saxatiles. 3. Littorales marini. 4. Fiſhes which frequent both rivers and the ſea. 5. Fiſhes which live only in rivers and lakes.

The orders of inſects are, 1. Terreſtrial inſects furniſhed with wings and feet. 2. Terreſtrial inſects which have feet, but not wings. 3. Terreſtrial inſects without feet. 4. The exangueous, which are ſubdivided into ſoft, cruſtaceous, and teſtaceous. 5. Zoophytes.

The ſerpents are diſtinguiſhed into terreſtrial, aquatic, and dragons without and with wings.

Dr Jonſton has conſiderable merit in abridging the enormous volumes of Aldrovandus and Geſner : His merit would have been ſtill greater, if, inſtead of abridging, he had totally rejected the accounts of many fictitious animals deſcribed and painted by theſe authors.

§ 12. Of WILLOUGHBY.

Francis Willoughby, Eſq; was the only ſon of Sir Francis Willoughby of Middleton in the county of Warwick. His amiable character, both as a gentleman and ſcholar, may be ſeen in Mr Ray's preface to the tranſlation of Willoughby's Ornithology, publiſhed in the year 1678. Mr Willoughby died in July 1672, when he was only in the 37th year of his age. After his death, Mr Ray having examined his manuſcripts, found the quadrupeds, birds, fiſhes, and inſects digeſted into a new method, but few of their deſcriptions and hiſtories ſo perfect as the author had intended. Thoſe defects, however, were afterwards ſupplied, at leaſt with regard to the birds and fiſhes, and publiſhed by Mr Ray himſelf. The ornithology appeared in Latin in the year 1676, and the hiſtory of fiſhes in the 1686, each of them accompanied with copperplate figures of the different ſpecies.

The deſign of the author cannot be better repreſented than in the words of Mr Ray: ‘ As for the ſcope of this undertaking, it was ‘ neither the author's, nor is it my intention, to write pandects of ‘ birds, which ſhould compriſe whatever had been before written of ‘ them by others, whether true, falſe, or dubious, that having been ‘ abundantly performed by Geſner and Aldrovandus. But our main ‘ deſign was to illuſtrate the hiſtory of birds, which is in many par‘ ticulars confuſed and obſcure, by ſo accurately deſcribing each ‘ kind, obſerving their characteriſtic and diſtinctive notes, and re‘ ducing all to their proper claſſes and genera, that the reader might ‘ be ſure of our meaning, and, upon comparing any bird with our ‘ deſcription, not fail of diſcerning whether it be the one deſcribed, ‘ or no *.’

But the juſtneſs of Mr Willoughby's ideas concerning the methodical diſtribution of animals will ſtill further appear from the following ſketch of his plan.

BIRDS.

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* Preface to the tranſlation of Willoughby's Ornithol.

BIRDS.

THESE our author comprehends under two general diviſions, viz. 1. Land-fowl. 2. Water-fowl.

The land-fowl are diſtinguiſhed into, 1. Birds with crooked bills and talons. 2. Birds with more ſtraight bills and claws.

Thoſe with crooked bills or talons are either, 1. Carnivorous and rapacious; or, 2. Frugivorous. 1. The carnivorous are ſubdivided into diurnal and nocturnal. The diurnal are again divided into the leſſer, and the greater. The greater diurnal birds are ſtill further divided into the more generous, called eagles; and the more cowardly and ſluggiſh, called vultures. The leſſer diurnal birds are in the ſame manner diſtinguiſhed into the more generous, called hawks, and which are capable of being taught to fowl; and the more cowardly and ſluggiſh, which, from their want of docility, are neglected by falconers. The generous are again diſtinguiſhed into long-winged, as the falcon, lanner, &c.; and ſhort-winged, as the goſhawk and ſparrow-hawk. The cowardly are divided into the greater, as the common buzzard, bald-buzzard, &c; and the leſſer, which is again divided into the European, as butcher-birds and ſhrikes; and the exotic, or birds of Paradiſe. The nocturnal are either horned, as the eagle-owl, horned-owl, &c.; or without horns, as the crown owl, gray owl, &c. 2. The Frugivorous are diſtinguiſhed into the greateſt kind, called macaws; the middle-ſized, called parrots; and the leaſt kind, called parroquets.

Birds with more ſtraight bills and claws are divided into the greateſt,

eſt, which, on account of the bulk of their bodies and ſmallneſs of their wings, cannot fly, as the oſtrich, the caſſiowary, and the dodo; the middle ſized; and the leaſt kind. The middle ſized are divided into ſuch as have large, thick, ſtrong, and long bills; and ſuch as have ſmaller and ſhorter bills. The large billed feed either promiſcuouſly upon fleſh, inſects, and fruits, and thoſe again are either wholly black, as the crow-kind, or party-coloured, as the pie-kind; upon fiſh, as the kings-fiſher, or upon inſects only, as the woodpeckers. The middle-ſized are diſtinguiſhed, by the colour of their fleſh, into the white, as the poultry-kind; and the black, which are again ſplit into the greater, as the pigeon-kind; and the leſſer, as the thruſh-kind. The leaſt kind, called ſmall birds, are diſtinguiſhed into the ſoft-beaked, or thoſe which have ſlender, ſtraight, and generally pretty long bills, and feed upon inſects; and the hard-beaked, or thoſe which have thick and ſhort bills, and feed moſtly upon ſeeds.

Birds of the ſecond diviſion, water-fowl, are diſtinguiſhed into, 1. Such as frequent waters and watery places, in queſt of their food. 2. Such as ſwim in water.

Thoſe that frequent watery places are divided into the greateſt, as the crane, jabiru, &c.; and the leſſer; which laſt is again diſtinguiſhed into piſcivorous, as the heron, ſpoon-bill, ſtork, &c.; and mudſuckers and inſectivorous. The mudſuckers have very long bills, which are either crooked, as the curlew, whimbrell, &c. or ſtraight, as the wood-cock, godwit, &c. middle-ſized bills, as the ſea-pie, redſhank, &c. or ſhort bills, as the lapwing and plover.

Thoſe that ſwim in the water are divided into cloven-footed, as the coot, &c. or whole-footed. The whole-footed are either long-legged, as the flammant, the avoſetta, &c. or ſhort-legged, which laſt are ſubdivided into ſuch as have three toes, as the penguin, the razor-bill, &c. and thoſe with four toes. The four-toed are again diſtinguiſhed into ſuch as have all the four toes connected by membranes, as the pelican, the ſolan-gooſe, &c. and ſuch as have the back-toe looſe; and theſe laſt are ſubdivided into narrow-billed, and broad-billed. The narrow-billed are diſtinguiſhed into ſuch as have blunt bills, hooked at the point, which are either ſerrated, as the diver, or not toothed, as the puffin, &c.; and ſuch as have ſharp-pointed and ſtraighter bills, which again are either ſhort-winged and divers, called duckers; or long-winged, and much upon the wing, called gulls. The broad-billed are divided into the gooſe-kind, which are larger; and the duck-kind, which are leſſer; and theſe laſt are either ſea-ducks, that dive much; or river and plaſh-ducks.

FISHES.

Order I. Cetaceous fiſhes, or thoſe which have lungs, are viviparous, and ſuckle their young, as the whale, the dolphin, the porpoiſe, &c.

Order II. Cartilaginous fiſhes, which are viviparous, have no ſcales, and, in place of gills, have on each ſide five oblong holes; have cartilages inſtead of bones; and the males have two appendages connected with the anal fins, which are thought to be mentulae.

The ſecond order, viz. The cartilaginous fiſhes, are divided into the proper, and leſs proper.

The proper are ſubdivided into long and cylindrical, and broad and plain fiſhes. The long cylindrical are diſtinguiſhed into ſuch as have longer, and ſuch as have ſhorter ſnouts: Thoſe with longer ſnouts are divided into ſuch as have teeth, and are either deſtitute of prickles, as the white ſhark, the blue ſhark, the ſea-fox, the balance-fiſh, &c.; or furniſhed with prickles, as the hound-fiſh, &c.; and ſuch as have no teeth, as the ſmooth hound-fiſh, &c.: Thoſe with ſhorter ſnouts, as the bounce, &c. are not ſubdivided. The broad and plain fiſhes are ſubdivided into thoſe with thinner tails, and thoſe with thicker tails. The thinner-tailed are either furniſhed with a ſpinous ray, as ſome of the ſea-eagles, &c. or with many prickles, which laſt are again divided into thoſe that are rough, as the white-horſe, thorn-back, &c.; and thoſe which are ſmooth, as the ſkate-fiſh, &c.

The leſs proper cartilaginous fiſhes have cartilage in place of bone; are oviparous, and furniſhed with gills, but have no mentulae; as the frog-fiſh, &c.

Order III. Spinous oviparous fiſhes, or thoſe which, for the moſt part, have prickles adhering to their bodies.

This order is divided into,

1. Plain ſpinous fiſhes, which project themſelves on their ſides when ſwimming, and are either ſhorter and more ſquare, as the turbot, or longer, as the ſole, &c.

2. Eel-ſhaped fiſhes, as the conger, the ſea-ſerpent, &c.

3. Fiſhes with more contracted bodies, and which have no belly-fins, as the orb, the ſun-fiſh, &c.

4. Fiſhes with ſoft and flexible rays in the back fins, which are divided into ſuch as have three back-fins, as the cod-fiſh, the whiting, &c.; ſuch as have two back-fins, as the ling, the tunny-fiſh, the mackerel, &c.; ſuch as have but one back-fin, and inhabit the ſea, as the herring, the pilchards, &c.; and ſuch as have but one back-fin, inhabit rivers, and want teeth, as the carp, the bream, &c.

5. Fiſhes having ſome rays in the back-fins furniſhed with ſharp prickles: Theſe are ſubdivided into ſuch as have two back-fins, the anterior of which has prickly rays, as the pearch, the flying fiſh, &c.; and ſuch as have one back-fin, with the anterior rays prickly and the poſterior ones ſoft, as the ſea-pearch, the ſtickleback, &c.

Mr Willoughby's deſcriptions are ſcrupulouſly accurate and minute. Beſides, where any difficulties occur in diſtinguiſhing one ſpecies from another, he generally ſubjoins a few ſhort marks, the more eaſily to aſcertain their differences. The hiſtorical part is conducted with great candour and modeſty, no facts being admitted but ſuch as either conſiſted with the author's knowledge, or were ſufficiently atteſted by men of learning and credit.

§ 13. Of RAY.

It is an unfortunate circumſtance, that men whoſe inclinations lead them to the cultivation of ſcience are ſo ſeldom endowed with thoſe nicer feelings which are neceſſary to the formation of taſte. A few individuals, impelled by conſtitutional inclination, by accident, or by neceſſity, apply the whole force of their minds to particular ſubjects. By this means new facts, and ſometimes new principles, are diſcovered. But theſe are too often uſhered into the world in ſuch a cold and forbidding manner, that, inſtead of attracting general attention, they are only peruſed by men of ſimilar tempers, who are equally ill qualified to recommend them. Natural hiſtory, a ſcience replete with variety, regularity, utility, and every ſpecies of beauty which can gratify the human intellect, laboured long under the oppreſſion of phlegmatic writers. During this period, the oeconomy of nature was almoſt entirely overlooked. Even thoſe who diſcovered a fondneſs for natural knowledge, inſtead of meeting with applauſe, were often deſpiſed and ridiculed: And, indeed, while naturaliſts continued to be only mere collectors of gnats and butterflies, they perhaps deſerved no better treatment.

In order to propagate a taſte for any ſcience, no other requiſite is neceſſary than a good writer to repreſent it in proper colours. Natural hiſtory, towards the end of laſt century, was powerfully recommended to the attention of mankind by the labours of our illuſtrious countryman, the Reverend Mr John Ray; a man ſo remarkable for ſolidity of learning and correctneſs of taſte, that, from peruſing his valuable works, it is difficult to diſcover which of theſe reſpectable qualities ſhone moſt conſpicuouſly in his character. Before this worthy author's time, although, as we have ſeen, ſeveral laudable attempts were made to reduce the ſubjects of natural hiſtory to a kind of methodical arrangement, none of their authors ſeem to have had ſuch comprehenſive views of nature as to enable them to form a ſyſtem founded upon ſolid principles. But as the character of Mr Ray and of his writings are ſo univerſally known and admired, it would be ſuperfluous to ſay any more on that ſubject.

We therefore proceed to give a ſhort view of the author's methodical diſtribution of animals.

Mr Ray, in the year 1693, publiſhed his Synopſis of Quadrupeds and Serpents. His Hiſtory of Inſects was publiſhed in the year 1710, by order of the Royal Society; and his Synopſis of Birds and Fiſhes in the 1713, under the inſpection of Mr Derham; both theſe laſt were printed ſeveral years after the author's death.

In the ſynopſis of quadrupeds, Mr Ray lays down a general diviſion of the animal kingdom, which he comprehends under two great claſſes, viz. 1. The ſanguineous. 2. The exangueous.

The ſanguineous are ſubdivided into thoſe which reſpire by lungs, and whoſe hearts are furniſhed with two ventricles; and thoſe which reſpire by gills, as all the ſanguineous fiſhes, except the cetaceous tribe. But ſome animals have two lungs, as the cetaceous fiſhes, viviparous quadrupeds, and birds; and others only one, as the oviparous quadrupeds and ſerpents. Animals with two lungs are either viviparous or oviparous. The viviparous are ſubdivided into aquatic, as the cetaceous fiſhes; and terreſtrial, as the quadrupeds covered with hair. The oviparous animals with two lungs comprehend the whole claſs of birds.

The exangueous are divided into the larger, which are either ſoft, as the cuttle-fiſh, &c. Cruſtaceous, as the lobſter, &c. or teſtaceous, which again are either furniſhed with one valve, two valves, or one turbinated; and the leſſer, which include inſects properly ſo called.

QUADRUPEDS.

Mr Ray divides viviparous quadrupeds into two orders, viz. I. Such as are hoofed. II. Such as have nails or claws.

The firſt order is ſubdivided into, 1. Whole-hoofed, as the horſe, aſs, and zebra. 2. Cloven-hoofed, which either ruminate, as the ſheep-kind, &c. or do not ruminate, as the hog-kind. The ruminating animals are again diſtinguiſhed into two kinds, viz. Such as do not caſt their horns, as ſheep, goats, &c. and ſuch as do caſt their horns, as the deer-kind. 3. Four-hoofed, as the rhinoceros, hippopotamus, &c.

The ſecond order, comprehending animals with nails or claws, are diſtinguiſhed, by the number of toes and nails or diviſions in their feet, into bifid, or thoſe furniſhed only with two toes or nails, as the camel-kind; and multifid, or ſuch as have more than two: The laſt are ſubdivided into ſuch as have undivided toes, or toes adhering to one another, and covered with a common ſkin, their extremities only ſtanding out, and fortified with obtuſe nails, as the elephant; and ſuch as have divided toes: Quadrupeds with divided toes have either broad nails like thoſe of men, as the ape-kind; or narrower claws, with cutting teeth in each jaw: Theſe are again diſtinguiſhed into ſuch as have many cutting teeth; and ſuch as have only two. Thoſe with many cutting teeth are all carnivorous and rapacious, or at leaſt feed upon inſects, or promiſcuouſly on inſects and vegetables, and are divided into the greater kind, furniſhed with a ſnout, which is either roundiſh, as in the cat-kind, or longer, as in the dog-kind; and the leſſer kind, with long ſlender bodies and ſhort legs, as the weaſel, otter, &c. Thoſe with two cutting teeth, are all herbivorous, as the hare-kind.—The hedge-hog, armadillo, mole, ſhrew-mouſe, ant-eater, bat, and ſloth are added here as anomalous.

The oviparous quadrupeds reſpire by lungs, and have but one ventricle in their hearts. Under this diviſion are comprehended frogs, tortoiſes, lizards, and ſerpents. The ſerpents are diſtinguiſhed into thoſe which have long, crooked, ſharp, exerted teeth, by which they bite and infuſe a venom into the wound, as the viper, the rattleſnake, &c.; and thoſe which have no ſuch teeth, and are not venomous, as the common ſnake, &c.

BIRDS AND FISHES.

In theſe two claſſes, the diviſions and principles of arrangement are ſo nearly the ſame with thoſe of Mr Willoughby, that it would be ſuperfluous to repeat them.

INSECTS.

Mr Ray, from the transformation of many inſects, comprehends the whole under the two following diviſions: I. Inſects which undergo no change from their original ſtate. II. Inſects which ſuffer a transformation.

The firſt diviſion is diſtinguiſhed into thoſe which have no feet; and thoſe which have feet. Inſects without feet are again either terreſtrial or aquatic. The land-inſects either live in the ground, as the earth-worms, or in the inteſtines of men and other animals, as the teretes, tænia, and aſcarides. The aquatic inſects are divided into the greater, as leeches, &c.; and the leſſer, as the ſmall worms called flukes, &c. Inſects with feet are diſtinguiſhed into ſuch as have 6 feet; ſuch as have 8 feet; ſuch as have 14 feet, as the woodlice, &c.; and ſuch as have many feet. The 6-footed inſects are divided into terreſtrial and aquatic. The terreſtrial are either larger, as meal-worms, &c.; or leſſer, as the bug, the common louſe, &c. The 8-footed inſects are either furniſhed with a tail, as the ſcorpion, or have no tail, as ſpiders, mites, &c. The many-footed inſects are likewiſe divided into terreſtrial, and cylindrical, as the julus; terreſtrial plain or compreſſed, as the ſcolopendræ; and aquatic, as the lugs or ſea-bait, &c.

In the ſecond diviſion, comprehending inſects which ſuffer a transformation, Mr Ray follows Swammerdam's method, who diſtinguiſhes them by the circumſtances attending their different changes. The firſt ſpecies of transformation is performed ſo ſuddenly, that hardly any time intervenes between the two different ſtates or forms of the animals, as in the dragon-flies, graſshoppers, crickets, &c. The ſecond ſpecies of transformation comprehends thoſe inſects which undergo a double metamorphoſis, being firſt changed to a chryſalis, remaining for ſome time without motion and without taking any nouriſhment, and then to a fly. Theſe are diſtinguiſhed, by their wings, into coleoptera, or thoſe which have cruſtaceous ſheaths covering their wings, as the beetles; and anelytra, or thoſe which have no ſuch covering to their wings; which laſt are ſubdivided into ſuch as have farinaceous wings, as the butterflies; ſuch as have four membranaceous wings, as bees, &c.; and ſuch as have two membranaceous wings, as the fleſh-fly, &c.

The third ſpecies of transformation is ſimply from a caterpillar to a fly, the caterpillar lying quiet for ſome time before its change, and comprehends ſeveral kinds of muſcæ.

N. B. This hiſtory and diſtribution of inſects was left in a crude ſtate, and never finiſhed for the preſs by the author.

The different ſynopſes of animals written by Mr Ray are not to be conſidered as mere technical diſtributions. His arrangements indeed are founded on good principles; and his deſcriptions are ſhort, but clear, and comprehenſive. However, beſides arrangement and deſcription, the author, particularly in his ſynopſis of quadrupeds, frequently ſubjoins a conciſe hiſtory of manners and diſpoſitions. In the arrangement and deſcriptions, extenſive erudition and a ſound underſtanding, joined to a habit of accurate obſervation, are eminently conſpicuous. In the hiſtory of individuals, Mr Ray diſcovers an elegancy of taſte, a ſcrupulous regard to truth, a manly philoſophical firmneſs, and, above all, a warm attachment to virtue and the genuine happineſs of mankind.

§ 14. OF ARTEDI.

PETRUS ARTEDI, a native of Sweden, and fellow ſtudent of Linnæus, with whom he lived in habits of the moſt intimate friendſhip, died at an early period of life, having fallen into a canal near Amſterdam, where he unfortunately periſhed in the 30th year of his age. Natural hiſtory was the ſubject in which he chiefly delighted; but he applied himſelf particularly to ichthyology, a branch of that ſcience which had been leaſt cultivated. After examining with the minuteſt attention all the fiſhes produced in his own country, Artedi travelled into Holland, Britain, &c. with a view to improve himſelf ſtill further in his favourite ſtudy. Not ſatisfied with the arrangement of Willoughby and Ray, he compoſed a ſyſtem founded upon different principles. After the death of Artedi, Linnæus procured his manuſcripts, and publiſhed his method and deſcription of fiſhes at Leyden in the year 1738.

Artedi diſtributes fiſhes into thoſe which have perpendicular tails, with rays in their fins; and thoſe which have horizontal tails. Thoſe with perpendicular tails are divided into bony fiſhes; and cartilaginous fiſhes. The bony fiſhes conſtitute three orders: 1. Malacopterygii, or fiſhes with ſmall bones in their gills, and ſoft rays in their fins, as the carp, the bream, the herring, &c. 2. Acanthopterygii, or fiſhes with ſmall bones in their gills, and pungent or prickly rays in their fins, as the mullet, the mackerel, the ſtickleback, &c. 3. Branchioſtegi, or fiſhes which have no bones in their gills, as the ſun-fiſh, the frog-fiſh, &c. There is but one order of the cartilaginous fiſhes, viz. the chondropterygii, or fiſhes the rays of whoſe fins are hardly diſtinguiſhable from the membrane; they have cartilages in place of bones, and their mouths are generally ſituated in the under part of their bodies, as the lamprey, the balance-fiſh, the ſkate, the ſhark, &c. The fiſhes with horizontal tails likewiſe conſtitute but one order, viz. the plagiuri, which comprehends the whale-kind.

The deſcriptions of Artedi are fuller and more ſcientific than thoſe of moſt ichthyologiſts. He has likewiſe added a multitude of ſynonimes.

§ 15. Of KLEIN.

Mr Klein, an ingenious methodiſt, publiſhed a new arrangement of fiſhes in the year 1740. Since that time, he has favoured the world with a methodical diſtribution of quadrupeds, birds, teſtaceous animals, and reptiles, &c.

Quadrupeds.

Theſe Mr Klein divides into the three following orders. I. Hoofed quadrupeds. II. Toed and hairy quadrupeds. III. Toed quadrupeds without hair.

The firſt order he ſubdivides into five families. 1. Quadrupeds with one hoof, as the horſe and aſs. 2. With double or cloven hoofs, as the ox-kind, the ſheep-kind, &c. 3. With three hoofs, as the rhinoceros. 4. With four hoofs, as the hippopotamus. 5. With five hoofs, as the elephant.

The ſecond order comprehends viviparous quadrupeds furniſhed with toes, and covered more or leſs with hair. Theſe are likewiſe ſubdivided into five families. 1. Quadrupeds with two toes, as the camel and ſilenus. 2. With three toes, at leaſt uniformly in the fore-feet, as the ſloth and ant-eater. 3. With four, uniformly in the fore-feet, as the armadillo, &c. 4. With five toes, uniformly in the fore-feet, as the hare, the ſquirrel, &c. 5. With anomalous feet, as the otter, caſtor, walrus, phoca, and manati.

The third order comprehends, 1. Quadrupeds covered with a ſhell, as the tortoiſes. 2. Quadrupeds covered with a hard cataphractous ſubſtance, as the crocodile. 3. Naked quadrupeds, as lizards, frogs, &c.

BIRDS.

Mr Klein divides birds into eight families. His principle of arrangement is ſolely derived from the number, ſituation, and ſtructure of the toes.

Order I. Birds with two toes, both placed forward, as in the oſtrich.

II. — With three unconnected toes, all placed forward, as the caſſiowary, the buſtard, the green plover, &c.

III. — With four toes, two before and two behind, as the parrots, woodpecker, cuckoo, &c.

IV. — With four toes, three before and one behind, as the eagle, vulture, hawk, owl, crow, pie, bird of paradiſe, lark, nightingale; the wren, the ſwallow, the linnet, the woodcock, the humming birds, the curlew, the gallinaceous tribe, the columbine tribe, the crane, &c.—A ſtrange, unnatural combination!

V. — With four toes, three before, connected by a membrane, the back-toe looſe, as ſwans, geeſe, gulls, divers, &c.

VI. — With four toes, all connected by a membrane, as the ſolen-gooſe, cormorant, &c.

VII. — With three toes placed forward, all connected by a membrane, as the guillemot, penguin, albatroſs, &c.

VIII. — With four toes, having lobes, or looſe membranes, adhering to the three fore-toes, and the back one generally without any lobe, as the creſted loon, the coot, &c.

FISHES.

Theſe are divided into three orders. The firſt comprehends ſuch as reſpire by lungs, as the cetaceous tribe. The ſecond order contains thoſe fiſhes which reſpire by occult gills, or gills which do not appear externally: Fiſhes of this kind are furniſhed with ſpiracles or ſmall holes, in ſome placed behind, in others laterally, and in others, in the thorax. The ſubdiviſions of this order are regulated by the number of theſe ſpiracles. The third order includes ſuch fiſhes as have viſible gills. Any thing remarkable in the head, mouth, and form of the body is employed for the ſubdiviſions of this order.

TESTACEA, OR SHELL ANIMALS.

Mr Klein makes two general diviſions of ſhell-animals, the firſt of which he calls cochlides, and the ſecond conchæ. The cochlides have teſtaceous ſpiral canals, ſmall and cloſe at one end, the ſpires gradually enlarging in a uniform proportion, till they terminate in the mouth of the ſhell. The conchæ are concave ſcouped ſhells, ſuch as limpets, muſcles, &c.

The cochlides are divided into ſimple and compound. The ſimple cochlides are ſpiral canals formed by a ſingle revolution of the ſhell, and are diſtributed into eight claſſes, viz. 1. Plain, as the nautilus, cornu ammonis, &c. 2. Convex, as the nerita, luna, &c. 3. Vaulted, as the pentadactylus, &c. 4. Elliptical, as the ear-ſhell, &c. 5. Conical, as the ſtrombus, &c. 6. Cochlea, or ſimple cochlides ſimilar to obtuſe and ſomewhat inclined cones, as the fornax, ſaccus, &c. 7. Buccinum, as the whelks and trumpet-ſhells. 8. Turbo, wreath or whirl-ſhells.—The compound cochlides are ſuch ſhells as have a double circumvolution, ſo that they appear to be compoſed of two. Theſe are divided into five claſſes. 1. Roſtrata, or beaked ſhells, as the gladius, &c. 2. Shells with a long volute, as the turricula, &c. 3. Shells with an oval volute, as the bulla, cithara, &c. 4. Alata, or winged ſhells, as the harpago, &c. 5. Murex, caltrop or rock-ſhells, as the triangular whelk, &c.

The conchæ are divided into ſix claſſes. 1. Monoconcha, or ſingle-valved ſhells, as the limpets. 2. Diconcha, or two-valved ſhells, are ſubdivided into equal and connivext, as oyſters, muſcles, &c.; equal and interrupted, as the chama, &c.; and inequal, as the terebratula, &c. 3. Polyconcha, or ſhells with more valves than two, as the anatifera or barnacle. 4. Niduli teſtacei, acorn-ſhells, or collections of ſhells in the form of little roundiſh neſts, either ſolitary or adhering to other ſea-bodies, as the balanus, &c. 5. Echini marini, or ſea-urchins. 6. Tubuli marini, or ſea-tubes.

REPTILES.

Theſe are divided into two orders. I. Anguis, comprehending the ſerpent tribe. II. Worms.

The firſt order is ſubdivided into, 1. Serpents with diſtinct heads and tapering tails: Theſe are again diſtinguiſhed into ſuch as have canine teeth, as the vipers; ſuch as have pectinated teeth, like the pike-fiſh, as the ammodites, &c.; ſuch as have teeth reſembling needles, as the coluber dipſas, aeſculapius, &c.; and ſuch as have no teeth, as the ſerpens ceraſtes of Seba, &c. 2. Serpents with undiſtinct heads, and truncated tails, as the amphiſbæna and ſcytale.

The ſecond order, viz. worms, are all included under three genera; 1. Lumbricus, comprehending earth-worms, water-worms, and ſuch as inhabit the bodies of animals. 2. Tænia, or the tape-worm. 3. Hirudo, or leech.

Mr Klein's method is ingenious; but his principles of arrangement are ſo limited, that very incongruous animals are often linked together.

§ 16. OF LINNAEUS.

THIS learned and indefatigable naturaliſt appeared in the character of a ſyſtematic writer as early as the year 1735. After that period, he gradually improved and enriched his *Syſtema Naturae* till the laſt edition of that valuable work, which he publiſhed at Holme in the year 1766-7. Since his death, however, Profeſſor Gmelin of Goettingen, with much induſtry and knowledge, publiſhed an improved edition, being the 13th, at Leipſic, in the year 1788. As twenty years had elapſed ſince the 12th edition was preſented to the public by the celebrated Linnaeus, many diſcoveries in the animal kingdom had been made, in different quarters of the globe, by laborious and ingenious travellers. Theſe Profeſſor Gmelin has not only collected and deſcribed, but has incorporared them into his edition of the Syſtema Naturae of Linnaeus, by which, without materially altering the plan and arrangement, he has highly enriched and enhanced the value and utility of the work.

Linnaeus diſtributes the animal kingdom into ſix Claſſes: I. Mammalia, or animals that ſuckle their young, which includes man, the quadrupeds, and the whale-kind. II. Birds III. Amphibious animals. IV. Fiſhes. V. Inſects. VI. Worms.

Class I. Mammalia.

I. The mammalia are divided into ſeven orders. The orders of the mammalia are chiefly regulated by the number and ſituation of the teeth. 1. *Primates*, or animals with one canine and four cutting teeth. This order includes man, and all the ape, monkey, and bat-kinds, 2. *Bruta*, or animals which have no cutting teeth in either jaw, as the elephant, ant-eater, &c. 3. *Ferae*, or animals whoſe cutting teeth vary from ten to two. This order comprehends moſt of the rapacious quadrupeds, as the dog, cat, and bear-kinds, &c. 4. *Glires*, or animals which have only two cutting and no dog-teeth, as the mouſe, ſquirrel, hare, &c. 5. *Pecora*, or animals which are hoofed, and have no cutting teeth in the upper jaw. This order includes the camel, the deer, the ſheep, and the ox-kinds, &c. 6. *Belluae*, or quadrupeds with cutting teeth in each jaw; as the horſe, the ſow, &c. 7. *Cetæ*, or animals, whoſe teeth vary greatly in different genera. This order comprehends all the cetaceous, or whale tribes, which Linnaeus, from certain ſimilarities of ſtructure, has arranged under the claſs of quadrupeds.

Class II. Birds.

This claſs Linnaeus divides into ſix orders. The diſtinctive characters of the orders are chiefly derived from the bills and the feet. 1. *Accipitres*, (eagle or hawk kind) birds with hooked bills, and ſhort, robuſt limbs. Under this order are comprehended vultures, falcons, owls, &c. They build their neſts in rocks, and elevated ſituations. II. *Picae*, (pies) or birds with bills ſhaped like a knife and convex on the backs. The limbs are fitted for walking, being ſhort and pretty ſtrong. They build their neſts in trees. III. *Anſeres* (ducks) have ſmooth bills, covered with a ſkin, and expanded at their termination. Their toes are connected by a membrane, which enables them to ſwim. They generally build their neſts on the ground. IV. *Grallae*, or birds with obtuſe and nearly cylindrical bills. The limbs are fitted for walking, and the thighs are partly deſtitute of feathers. They generally build their neſts on the ground. To this order belong cranes, ſnipes, &c. V. *Gallinae*, or birds with convex bills. The toes are divided, but ſtrongly connected above by articulations, and fitted for walking or running. This order comprehends the pheaſant, grous, peacock, &c. kinds. VI. *Paſſeres*, or birds with conical ſharp-pointed bills. To this order belong the pigeon, the ſwallow, the thruſh, &c. kinds.

Class III. Amphibious Animals.

This claſs comprehends all thoſe animals which, from certain peculiarities in the ſtructure of their lungs, are enabled to live either in air or in water. Linnaeus divides this claſs into two orders. 1.

Reptilia pedata, or reptiles furniſhed with feet, including turtles, lizards, frogs, &c. II. *Serpentes apodes*, or reptiles without feet. This order comprehends all the ſerpent and ſnake kinds.

CLASS IV. FISHES.

In the claſs of fiſhes, which Linnaeus divides into ſix orders, the principal marks of diſtinction are derived from peculiar circumſtances attending the gills and fins. The firſt four orders comprehend all thoſe fiſhes which have oſſeous gills; and this fact muſt be underſtood as applicable to the other characters the author employs to diſtinguiſh theſe orders.

Order I. *Apodes*, or fiſhes which have no ventral, or belly fins. This order comprehends all the eel tribes, whether they inhabit ſeas, lakes, or rivers. 2. *Jugulares*, or fiſhes with the ventral placed before the pectoral fins, as in the haddock, whiting, ling, &c. kinds. 3. *Thoracici*, or fiſhes with the ventral ſituated near the pectoral fins, as in the feather-laſher, holibut, plaiſe, &c. 4. *Abdominales*, or fiſhes with the ventral ſituated behind the pectoral fins, as the pike, the mullet, the herring, &c. 5. *Branchioſtegi*, or fiſhes whoſe gills are deſtitute of oſſeous matter, as the ſun-fiſh, pike-fiſh, frog-fiſh, &c. 6. *Chondropterygii*, or fiſhes with cartilaginous gills, as the ſturgeon, dog-fiſh, balance-fiſh, &c.

CLASS V. INSECTS.

Under this claſs Linnaeus comprehends all animals which are provided with *antennae*, or feelers, ſituated in the fore-part of their heads. The orders of inſects, which are ſeven in number, are chiefly derived from their wings. They are diſtinguiſhed into thoſe which have four, thoſe which have two, and thoſe which are deſtitute of wings. To the firſt order Linnaeus gives the appellation of *coleoptera*, or four winged inſects whoſe upper pair conſiſt of a cruſtaceous or horny ſubſtance, and join in a ſuture or ridge. Theſe cover and defend the under pair, which are of a ſoft and flexible texture. This order includes the whole *ſcarabaei* or beetle tribe. 2. *Hemiptera*, inſects which have likewiſe four wings; but the upper pair, inſtead of being hard and horny, have a reſemblance to fine vellum, as in *graſshoppers*, *locuſts*, *crickets*, &c. 3. *Lepidoptera*, or inſects whoſe wings are covered with imbricated ſcales. This order comprehends all the *butterfly* and *moth* tribes. 4. *Neuroptera*, or inſects with four membranaceous wings, ſo interſperſed with delicate veins, that they reſemble beautiful net-work, as the *dragon-fly*, the *ſpring-fly*, &c. 5. *Hymenoptera*, or inſects with four membranaceous and naked wings, as the *waſp*, the *bee*, &c. In ſome of the genera, however, arranged under this order, the neuters, and, in others, the males, or even the females, have no wings. Their tails, except in the male ſex, are armed with a ſting. 6. *Diptera*, or two winged inſects. Beſide wings, the ſpecies of this order are furniſhed with what is called a *balter*, or a *poiſer*, which is ſituated under each wing, and terminates in a *capitulum*, or knob. Under this diviſion are comprehended the *gad-fly*, the *gnat*, &c. 7. *Aptera*, or inſects which are deſtitute of wings, as the *louſe*, the *flea*, the *ſcorpion*, &c. VI. *Vermes*, or *worms*. This order includes not only all the inſects commonly called *worms*, but all the teſtaceous animals, and the zoophytes, or plant-animals.

§ 17.

§ 17. OF BUFFON.

I. OF QUADRUPEDS.

THE firſt volume of the *Hiſtoire Naturelle, generale et particuliere, avec la Deſcription du Cabinet du Roi*, was publiſhed at Paris in the year 1749. The hiſtorical part is the compoſition of M. de Buffon; the deſcriptive and anatomical parts are written by M. Daubenton. To avoid, however, the frequent repetition of two names, we ſhall uſe that of Buffon only.

We found not much difficulty in giving ſhort views of the writings of thoſe naturaliſts who preceded the celebrated author now before us. If we may judge of the character of a man from his literary performances, M. de Buffon, when tried by this teſt, appears in ſuch a variety of agreeable and brilliant aſpects, that, unleſs he be ſurveyed with uncommon coolneſs and attention, the imagination of the reader will be hurried away by an almoſt irreſiſtible torrent of eloquence. Conſcious of the ſtrength of his own genius, he diſdains the fetters and dull formalities of methodical diſtribution, which men of leſs fancy, but perhaps of ſuperior judgement, have uniformly regarded as an eſſential article in the communication of ſcience. To give ſome idea of our author's fertility and copiouſneſs, it ſhall only be mentioned, that his hiſtory of quadrupeds alone conſiſts of 15 large volumes in 4to. But when the multiplicity of ſubjects which he embraces are attended to; when we find him employing a whole volume on the method of ſtudying natural hiſtory, and on the theory of the earth; another in order to ſupport a peculiar theory of generation; a third in deſcribing the articles contained in the cabinet of the king, and the various races of men; a long diſcourſe on the nature of animals, another reprobating methodical arrangements; and, above all, when it is conſidered that the author was a moſt eloquent and ingenious Frenchman, we have reaſon to be ſurpriſed that he ſhould have begun the hiſtory of his firſt quadruped ſo early as in the middle of the fourth volume.

The deſign of the preſent chapter obliges us to confine our obſervations chiefly to that part of M. de Buffon's work which contains the principles upon which he thinks natural hiſtory ought to be taught and ſtudied.

M. de Buffon aſſerts *, that all methodical diſtributions are purely arbitrary; and, therefore, that every man is at liberty to chuſe that which is moſt convenient, or moſt generally received. Let us ſuppoſe a man, he remarks, totally void of ideas, and conſequently unbiaſſed by prejudices of every kind. Place this man in a country ſtored with quadrupeds, birds, fiſhes, and plants. At firſt he will not be able to diſtinguiſh one object from another; but, allow his ideas to be gradually unfolded by reiterated impreſſions from the ſame objects, and he will ſoon be in a capacity to diſtinguiſh animated from inanimated matter; in a ſhort time afterward, he will likewiſe perceive the difference between animal and vegetable ſubſtances, and thus naturally arrive at the firſt great diviſion of natural bodies into Animal, Vegetable, and Mineral. As by this time he will have acquired diſtinct ideas of thoſe grand objects, Earth, Air, and Water, he will ſoon form a particular notion of ſuch animals as inhabit theſe different elements, and, of courſe, will eaſily make a ſecond

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* Hiſt. Nat. tom. 1. p. 31. et ſeq. 4to. a Paris, 1749-1772.

cond diviſion of animals into quadrupeds, birds, fiſhes, &c. Let us next ſuppoſe, continues our author, that this man has acquired an equal portion of knowledge and experience with ourſelves, and he will form a judgment of the objects of natural hiſtory ſolely by the relations which they reſpectively have to himſelf. Thoſe which are moſt neceſſary or uſeful to him will occupy the firſt rank; for example, in arranging quadrupeds, he will give the preference to the horſe, the dog, the ox, &c. Thoſe which inhabit the ſame country, as the ſtag, the hare, and, in general, all the wild or undomeſticated animals, will be the next in order: Laſtly, his curioſity will prompt him to inquire into the nature of ſuch animals as inhabit foreign climates, and will proceed in the ſame manner with regard to birds, fiſhes, inſects, teſtaceous animals, plants, minerals, and every other production of nature. This our ingenious author ſuppoſes to be the moſt natural order, and, accordingly, obſerves it in his hiſtory of animals. We ſhall mention his arrangement of quadrupeds in a more ſimple form from the 168th page of the 4th volume—I. Domeſtic quadrupeds. II. Wild quadrupeds. III. Foreign quadrupeds.

We ſhould be apt to imagine that M. de Buffon, when he laid down this principle of arranging animals, had not only been miſtaken in his philoſophy, but had forgotten the ſubject upon which he was writing: That young and uninformed minds gradually acquire additions to their ſtock of ideas from the objects which ſurround them and ſolicit their attention, or, in other words, that objects, in proportion to the novelty of their appearance, and the utility they promiſe to afford us, make the deepeſt impreſſions on our minds, and, of courſe, their properties are not only firſt attended to, but more minutely inveſtigated than thoſe which are either more diſtant or leſs intereſting, is a fact that cannot admit of a doubt. But the obſervation, however juſt, is here miſapplied. If we did not know that M. de Buffon was endeavouring to aſcertain the principles of arranging the animal world, we ſhould be led to think that he was tracing the manner in which ideas were acquired, and the proportional force of the impreſſions we receive from external objects. But, who would not be aſtoniſhed to ſee this fact applied to a ſcience of an oppoſite nature, and conſtructed upon very different principles? There are many other relations by which mankind are connected to the animate and inanimate productions of Nature than what ariſe from utility and local ſituation. Beſides, the principle is extremely limited and defective. The connection of mankind with natural objects is, in many caſes, entirely caſual, depending on the climate, the ſtate of the ſociety in which he lives, with regard to culture, inſtitutions, prejudices, and a thouſand fortuitous circumſtances. Again, are there no natural relations between the various tribes of brute animals? Are they all related to man, without any connection among themſelves? Have they no common properties in the form of their bodies, their movements, or in the internal powers by which their actions are governed? M. de Buffon will not go ſo far; and yet he makes very near approaches. 'An aſs,' ſays he, 'is an aſs, and a cat, a cat *.' 'Nature,' he remarks, in another place †, 'proceeds from one ſpecies to another by ſuch imperceptible degrees, that we are often tempted to link many of them together as belonging to the ſame family. We ought not, however, 'to forget, that theſe families, or genera, are created by ourſelves, 'in order to aſſiſt the underſtanding; and that, if we cannot comprehend the real connections of natural objects, it is our own fault, 'and

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* L'Hiſt. Nat. vol. I. p. 40.

† Ibid. vol. 4. p. 384. et ſeq.

‘ and no defect in Nature, who knows nothing of thoſe pretended ‘ families, and who, in fact, has only made individuals. An individual is a detached being, which has nothing in common with ‘ other beings, except that it reſembles, or rather differs from them. ‘ All the ſimilar individuals which exiſt upon this earth are conſidered as compoſing the ſpecies of theſe individuals. It is not, ‘ however, the collective number of individuals, but their conſtant ‘ ſucceſſion and renovation, which conſtitute their ſpecies.’

In this and many other paſſages, M. de Buffon endeavours to perſuade us, that no ſuch thing as genus exiſts in Nature, but that all her productions are unconnected ſpecies, or mere collections of ſucceſſive individuals. He allows, indeed, that the connections or differences of many ſpecies are often ſo imperceptible, that we are in danger of concluding them to be of the ſame family. This admiſſion is ſufficient. It relinquiſhes the very point for which he ſo ſtrenuouſly contends; a circumſtance by no means uncommon in the works of this moſt ingenious, but verſatile author. If Nature has made the connections of different ſpecies ſo ſtrong that it requires conſiderable attention to diſcover their differences, it cannot be ſuppoſed that ſhe had no deſign in this plan of operation. Her benevolent intentions, on the contrary, are numerous. The intimate connections and nice diſtinctions of natural objects give riſe to an immenſe variety of beings, which could not poſſibly exiſt, if the gradations were larger and the diſtinctions more apparent. They aſſiſt the mind in forming general and comprehenſive views of the univerſe. They are the foundation upon which every art and ſcience is conſtructed, as, without their aſſiſtance, no man could form an abſtract or general idea; it is needleſs to ſay more. We ſhould, indeed, have conſidered it ſuperfluous to have reaſoned with a philoſopher who denies the exiſtence of genus in the univerſe, had his knowledge and taſte been as capricious as his ſcientific principles.

For what purpoſe, then, it may be aſked, has M. de Buffon given himſelf the trouble of writing, and his readers the labour of peruſing ſo much argumentation upon a ſubject ſo obvious? To ridicule all preceding and cotemporary writers who have obſerved method in their works, and perſuade mankind that Nature prefers confuſion to order! M. de Buffon, however, is ſo very unſtable, that he ſeldom long preſerves his poiſe. In the paſſage formerly quoted, he denies the exiſtence of genera. But we muſt ſuppoſe him to have entirely overlooked what he had ſaid in the 140th page of the ſame volume. Let us attend to his ſentiments at that time. 'We have already,' ſays he, 'many connected facts and obſervations with regard to the 'different ſpecies of animals, which are employed as diſtinguiſhing 'characters in the various methodical diſtributions. In theſe me'thods we find an uniform deſcription of the ſame parts in each dif'ferent animal. This is ſo conformable to our plan, that we ſhall 'have recourſe to thoſe deſcriptions in treating of ſuch foreign ani'mals as we have never ſeen. There is ſtill another advantage to 'be derived from thoſe methods: They ſupply us with general 'concluſions from a great number of particular obſervations. The 'reſemblance of particular parts in different ſpecies of animals forms '*generic characters*. The reſemblances which take place between 'animals belonging to different *genera* form ſtill more extenſive cha'racters, by which orders and claſſes are determined. Thus, the 'characters of the genera, orders, and claſſes, are ſo many general 'conſequences derived from particular obſervations, and, of courſe, 'are neceſſary facts in the hiſtory of animals.'

It may be farther remarked, that M. de Buffon's method of claſſing animals is founded entirely upon a confined and local idea. Domeſtic, wild, and foreign animals, with a few exceptions, vary according to the climate and ſtate of the country in which a man lives. The rein-deer is a domeſtic animal in Lapland, and the ichneumon is a domeſtic in Egypt; but both are foreign animals in France. The guinea-pig is naturally a foreigner in Europe; but it is now a domeſtic in France and in ſeveral other European countries. Many examples might be added to ſhew the abſurdity of this method of arranging natural hiſtory; but, as one grand and uniform example, and which, indeed, includes all other examples, we ſhall refer the reader to the *Hiſtoire Naturelle et particuliere* of M. de Buffon, where he will find animals ſucceſſively deſcribed in the greateſt confuſion which the moſt capricious fancy can imagine. But, to give ſome idea of the confuſion reſulting from this order, the ingenious Mr Pennant ſeriouſly tells us, in the Preface to his excellent Synopſis of Quadrupeds, that the book was originally deſigned for private amuſement, and as an index for the more eaſily finding any particular animal deſcribed in the voluminous hiſtory of quadrupeds by the celebrated M. de Buffon.

But it is time to take a more agreeable view of this great and admirable writer. His hiſtory of animals is compoſed in ſuch a lively, entertaining, and inſtructive manner, that it muſt be highly reliſhed by every reader of taſte. His facts are numerous, his anecdotes are pleaſant, his characters are ſtrongly marked. Some people think his writings diffuſe; but it is univerſally agreed, that this diffuſion is ſo natural, and ſo bewitching, that the diſcovery is never made till the reader has peruſed the whole ſubject of which the author is treating.

How eaſily do mankind deceive themſelves, and how naturally does this deceit lead them into contradiction and abſurdity? M. de Buffon, in the 26th page of his firſt volume, juſtly reprehends Aldrovandus for intolerable prolixity; and tells us, that his hiſtory might be reduced to one-ſixth of its preſent ſize, if the immenſe load of uſeleſs and foreign matters were removed. But, the ingenious Frenchman had not the moſt diſtant idea, when he made this pertinent remark, that he was writing a ſevere ſatire on his own book, which had, by that time, ſwelled to eighteen large volumes in quarto, beſides his hiſtory of birds, which conſiſts of nine volumes more; and, if he had fortunately lived to complete his plan, the work would have been a much more ponderous load than that of the voluminous German.

We ſhall diſmiſs this learned and laborious compoſition, with a few obſervations on the deſcriptive part; for which we are indebted to the ſkill and indefatigable induſtry of M. Daubenton. The deſcriptions are generally taken from the life, and with ſuch aſtoniſhing minuteneſs, that it is not without reluctance we are obliged to think a great part of this labour uſeleſs. Our author's plan of deſcribing is ſo extenſive, that every minute part of the body, whether external or internal, is not only fully deſcribed, but its length, breadth, and thickneſs, are accurately meaſured. He takes an individual of a ſpecies, and, after a general deſcription, he proceeds to a menſuration of the particular parts, as the length of the head; the contour of the mouth; the diſtance between the angles of the under jaw; the diſtance between the noſtrils; the length of the eye from one angle to the other; the diſtance between the two pupils; the diſtance between the ears, &c. He is equally minute in the dimenſions of the different bones of the ſkeleton, and of the heart, lungs, ſtomach, and other inteſtines.

The general dimenſions are neceſſary; as, without theſe, a diſtinct idea of the animal could not be conveyed. But exact meaſurements of every minute part of which the different members of the body are compoſed, render the deſcription not only tedious and perplexed, but ſwell the book to an enormous ſize. Beſides, the dimenſions will not correſpond with thoſe of any other individual of the ſame ſpecies. Deſcribe and meaſure a man, or any other animal, in this manner, and you may travel from the one pole to the other without finding another individual to whom theſe dimenſions will exactly apply.

II. Of Birds.

Every admirer of the productions of nature muſt congratulate himſelf that the life of the great, the ingenious, and the laborious M. de Buffon was continued till he had been enabled to complete his Natural Hiſtory of Quadrupeds, as well as that of the feathered tribes.

In this laſt department of Natural Hiſtory, he had a thouſand difficulties to encounter; particularly in deſcribing and diſtinguiſhing the ſmaller ſpecies of birds, who not unfrequently intermix, and produce numerous fertile varieties. For this reaſon, in his plan of the work, he remarks that, inſtead of deſcribing birds by diſtinct and ſeparate ſpecies, he has united ſeveral of them under the ſame ſpecies. By this method, he has conſiderably abridged the Natural Hiſtory of Birds; which, upon a more extenſive ſcale, would have been too voluminous and unintereſting. He, therefore, confines his deſcriptions to domeſtic birds, and to the larger or more remarkable ſpecies. All the other birds, and particularly the ſmaller kinds, he unites with their kindred ſpecies, and groupes them together, as being nearly of the ſame natural diſpoſitions, and as belonging to the ſame family. The number of relations, as well as that of varieties, is always greater in proportion to the ſmallneſs of the ſpecies. A ſparrow or a linnet have, perhaps, twenty times more parents than thoſe of the oſtrich or the turkey. By the number of parents is to be underſtood the number of neighbouring ſpecies, which have ſuch reſemblances to each other as to make them be regarded as collateral branches of the ſame ſtem.—Theſe neighbouring ſpecies have probably been ſeparated from each other by the influence of climate, of food, and of the ſucceſſion of time, which brings along with it all poſſible combinations, and unfolds all the cauſes of variegation, of perfection, of change, and of degeneration. Independently of natural and accidental varieties, which are much more numerous among birds than quadrupeds, another cauſe concurs in augmenting apparently the number of ſpecies. Birds, in general, are more libidinous and more prolific than quadrupeds. They unite more frequently; and, when they cannot find females of their own ſpecies, they intermix more freely than quadrupeds with neighbouring ſpecies, and commonly produce fertile mules. This fact is eſtabliſhed by the ſpontaneous commixture of the goldfinch and canary bird; for the mongrels they produce by their union are prolific, and, of courſe, form new intermediate ſpecies, which have more or leſs reſemblance to the parents from whom they derive their origin. Now, whatever we procure by art may be, and actually is, performed by Nature. Fortuitous and voluntary commixtures often happen among animals of different ſpecies, and particularly among birds, who frequently, when their natural mates cannot be obtained, uſe the firſt bird, ſimilar in magnitude, that preſents itſelf. The neceſſity of union is ſo preſſing, that moſt birds, in this ſituation, are ſick, and not unfrequently die, when prevented from gratification. In court-yards, we often ſee a cock, when ſeparated from hens, lay hold of another cock, of a capon, of a guinea-hen, or of a duck. The pheaſant, in the ſame ſituation, makes uſe of a common hen. In volaries, the canary and goldfinch, the red and the common linnet, unite with ardor; and who knows what amours take place in the deep receſſes of the woods? who can recount the number of illegitimate embraces among different ſpecies? who can divide the baſtard branches from the genuine ſtems *?

Having given an account of M. de Buffon's Natural Hiſtory of Birds, nearly in his own words, it is almoſt ſuperfluous to remark, that, in this branch of the ſcience, he uniformly preſerves the character he had formerly acquired. His deſcriptions are accurate and clearly expreſſed; his hiſtorical narrations are not only elegant and entertaining, but diſcover great learning, candour, and deep reſearch.

§ 18. OF BRISSON.

M. BRISSON, in the year 1756, publiſhed at Paris a Synopſis of Quadrupeds and Cetaceous Animals; and a new arrangement of Birds in 1760.

QUADRUPEDS.

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* Buffon, Hiſt. Nat. des Oiſeaux, tom. 1. Plan de l'ouvrage, p. 20.

Quadrupeds,

These M. Briſſon diſtributes into eighteen Orders.

Ord. I. Comprehends ſuch quadrupeds as have no teeth in either jaw; as the ant-eater and ſcaly lizard.

II. Quadrupeds furniſhed with grinders only, as the ſloth and armadillo.

III. ——With grinders and dog-teeth only, as the elephant, morſe, and manati.

IV. ——With ſix cutting teeth in the under jaw only, as the camel.

V. ——With eight cutting teeth in the under jaw, as the giraffe, the goat-kind, the ſheep-kind, &c.

VI. ——With cutting teeth in each jaw, and whole-hoofed, as the horſe and aſs.

VII. ——With cutting teeth in each jaw, and cloven-hoofed, as the hog-kind.

VIII. ——With cutting teeth in each jaw, and three-hoofed, as the rhinoceros.

IX. ——With two cutting teeth in each jaw, as the river-hog.

X. ——With ten cutting teeth in each jaw, as the tapiir, or elephant-hog.

XI. ——With cutting teeth in each jaw, and four-hoofed, as the hippopotamus.

XII. ——With toes and claws, and two cutting teeth in each jaw, as the porcupine, caſtor, hare, ſquirrel, mouſe, &c.

XIII. ——With toes and claws, and four cutting teeth in each jaw, as the ape-kind, &c.

XIV. ——With toes and claws, four cutting teeth in the upper, and ſix in the under jaw, as the bats, &c.

XV. ——With toes and claws, ſix cutting teeth in the upper, and four in the under jaw, as the ſeal.

XVI. ——With toes and claws, and ſix cutting teeth in each jaw, as the hyæna, the dog-kind, weſels, badgers, bears, and cats.

XVII. ——With toes and claws, ſix cutting teeth in the upper and eight in the under jaw, as the mole.

XVIII. ——With toes and claws, ten cutting teeth in the up and eight in the under jaw, as the opoſſum-kind.

CETACEOUS ANIMALS.

AFTER the example of Linnæus, M. Briſſon places the whale-tribe next to the quadrupeds, and divides them into four orders.

Ord. I. Without teeth, as the Greenland whale, North-caper, the bunch-back whale, &c.

II. With teeth in the under jaw only, as the catodon or potwal-fiſh, the ſpermaceti-whale, &c.

III. With teeth in the upper jaw only, as the monoceros.

IV. With teeth in each jaw, as the dolphin, the porpeſſe, the grampus, &c.

BIRDS.

M. BRISSON divides birds into twenty ſix Orders.

Ord. I. Birds with four unconnected toes, three forward, one backward, having their legs covered with feathers nearly down to the talons, a ſtrait bill, the upper mandible a little thicker, and crooked toward the point, and the noſtrils half covered with a thick ſoft membrane, as in the pigeon-tribe.

II. The ſame characters, with a conical bill bent inward, as in the gallinaceous tribe.

III. ——With a ſhort hooked bill, comprehending eagles, hawks, &c.

IV. ——With a long conical bill, as in pies, &c.

V. ——With a ſtrait bill, and the edges of each ſide of the upper mandible emarginated, as in the butcher's bird, &c.

VI. ——With a ſtrait bill, and both mandibles entire, as in the beef-eater, &c.

VII. ——With a ſlender bill, a little bent arch-ways, as in the hoopoe, &c.

VIII. ——With a very ſmall bill, compreſſed at the baſe, crooked at the point, and the mouth, when open, larger than the head, as in the goat-ſucker, &c.

IX. ——With a ſhort conical bill, as in the ſparrow, &c.

X. ——With a bill ſhaped like an awl, as the lark, &c.

XI. ——With a bill ſhaped like a wedge, as the ſitta, &c.

XII. ——With a bill long and ſlender like a thread, as the honey-ſucker, certhia, &c.

XIII. Birds with four unconnected toes, two forward, two backward, as parrots, &c.

XIV. Birds with four toes without membranes, three forward, one backward, the middle toe firmly adhering to the outmoſt as far as the third joint, as the manakin, bee-eater, &c.

XV. Birds with unconnected toes, the inferior part of the limbs naked, the wings ſmall in proportion to the ſize of the body, and unfit for flying, as the oſtrich, caſſowary, &c.

XVI. Birds with three unconnected toes, all forward, the inferior part of the limbs naked, and the wings large and proper for flying, as the plover, &c.

XVII. Birds with four unconnected toes, three forward, one backward, the inferior part of the limbs naked, and the wings fit for flying, as the jacamu, woodcock, heron, &c.

XVIII. Birds with four unconnected toes, three forward, one backward, all furniſhed with membranes through their whole extent, as the coot, gallinule, &c.

XIX. Birds with four toes, the three anterior of which are connected by a membrane extending about one half of their length, the poſterior toe looſe, and the legs placed far back, and nearly concealed by the abdomen, as the grebe, &c.

XX. Birds with three toes forward, wholly connected by a membrane, and no back-toe, with the legs ſituated as in Order 19. as the guillemot, penguin, &c.

XXI. Birds with four toes, the three anterior ones entirely connected by a membrane, and the back one looſe, with the legs ſituated as in Order 19. as the diver, &c.

XXII. Birds with three toes forward entirely connected by a membrane, and no back-toe; the legs placed near the middle of the body, and ſhorter than the body, as the albatroſs, &c.

XXIII. Birds with four toes, the three anterior entirely connected by a membrane, and the back one looſe; the legs placed near the middle of the body, and ſhorter than the body: and the bill having no teeth, as the petrel, gulls, &c.

XXIV. The ſame character with the former, only the bill is dentated, as the merganſer, duck, &c.

XXV. Birds with four toes, all entirely connected by a membrane, the limbs placed near the middle, and ſhorter than the body, as the cormorant, pelican, &c.

XXVI. Birds with four toes, the anterior three joined by a membrane,

brane, and the poſterior one looſe; the legs placed near the middle, and longer than the body, as the flamingo, avocette, &c.

M. Briſſon diſcovers himſelf to be an able naturaliſt. His deſcriptions are clear, conciſe, and pointed. His principles of arrangement are ingenious, but too confined to anſwer the purpoſes of a general ſyſtem of Nature.

§ 19. OF PENNANT.

FOR more than twenty years paſt, this gentleman has been occaſionally enriching the ſcience of Natural Hiſtory by uncommon induſtry, knowledge, and ingenuity. Beſides his other valuable works, he has favoured the world with new arrangements of quadrupeds, birds, reptiles, fiſhes, and ſhell-animals.

In claſſing quadrupeds, Mr Pennant, as he candidly acknowledges, makes Mr Ray, that celebrated naturaliſt, his principal guide; but, from more recent diſcoveries, and other circumſtances, he has been enabled to improve Mr Ray's arrangement.

CLASS I. QUADRUPEDS.

MR PENNANT divides quadrupeds into four orders. I. Hooſed quadrupeds, as the horſe, ox, ſheep, deer, &c. II. Digitated, or toed, quadrupeds, including apes, monkies, dogs, cats, &c. III. Pinnated or finned, as the walrus, ſeals, &c. IV. Winged quadrupeds, drupeds, as all the bats, twenty one ſpecies of which are known and deſcribed.

Class II. Birds.

This numerous claſs of animals Mr Pennant comprehends under two great diviſions, viz. I. Land birds. II. Water birds. Theſe two he ſubdivides into nine orders: Diviſion I. Land birds. Order 1. Rapacious birds, as the vultures, falcons, owls, &c. 2. Pies, as the parrot, cuckoo, crow, kingsfiſher, &c. 3. Gallinaceous, as the turkey, peacock, partridge, &c. 4. Columbine, including all the ſpecies or varieties of pigeons. 5. Paſſerine, comprehending all the ſmall birds, from the ſize of a thruſh to that of the golden-creſted wren, of which the lark, the wagtail, the ſwallow, &c. are examples. 6. Struthious. This order includes the dodo, the oſtrich, and caſſowary, the moſt limited of all the ſubdiviſions of the feathered tribes. Diviſion II. Order 7. Cloven-footed, or waders, as the heron, ſnipe, plover, &c. 8. Birds with pinnated feet, as the coot, grebe, &c. 9. Web-footed, as the duck, gull, pelican, &c.

Class III. Reptiles.

Mr Pennant defines this claſs in the following terms: ‘ Body ‘ covered either with a ſhell or ſtrong hide, divided by ſutures; four ‘ fin-like feet; and a ſhort tail.’ Under this claſs are comprehended the tortoiſe, the frog, the lizard, the viper, and the ſnake kinds.

CLASS IV. FISHES.

THESE animals Mr Pennant ſeparates into three orders, or diviſions. I. Cetaceous fiſhes, comprehending all the whale-tribe. II. Cartilaginous fiſhes, or fiſhes whoſe muſcles are ſupported by cartilages, inſtead of bones. The lamprey, ſkate, ſhark, &c. are examples. III. Bonny fiſhes, whoſe muſcles are ſupported by bones or ſpines. In the ſubdiviſions of this order, Mr Pennant follows Sir Charles Linnæus. 1. Apodal, or fiſhes which are deſtitute of ventral fins, as the eel, wolf-fiſh, ſword-fiſh, &c. 2. Jugular, or fiſhes which have the ventral fins placed before the pectoral, as in the haddock, cod-fiſh, &c. 3. Thoracic, or fiſhes with the ventral fins ſituated beneath the pectoral, as in the flounder, perch, mackerel, &c. 4. Abdominal, or fiſhes whoſe ventral fins are placed behind the pectoral, as in the ſalmon, pike, herring, carp, &c.

CLASS V. CRUSTACEOUS ANIMALS.

UNDER this claſs Mr Pennant comprehends the numerous tribes of crabs, lobſters, &c.

CLASS VI. WORMS.

THESE are divided into, I. The inteſtine; II. The ſoft; III. The teſtaceous. Under diviſion I. Mr Pennant comprehends the hair worm, the aſcarides, and ſuch worms as infeſt the inteſtines of men and other animals, leeches, &c. II. Molluſca, or ſoft-worms, as the ſlug, the aphrodita, the cuttle-fiſh, &c. III. Teſtaceous, or animals furniſhed with ſhells. Theſe are ſubdivided into, *a.* Multivalved ſhells, as the barnacle, &c. *b.* Bivalved ſhells, as the muſcles, razor-ſhell, oyſter, cockle, ſcallops, &c. *c.* Turbinated ſhells, or thoſe which have ſpiral turns, as the turbo, or wreath, the periwinkle, the terebra or auger, garden ſnail, &c. *d.* Univalve ſhells not turbinated, as the common limpet, &c.

I AM not without apprehenſion that this Chapter, to ſome readers, may appear to be dry and unintereſting. I ſhall only remark, that it has coſt me much labour, as muſt be evident from the numerous and voluminous works which I have been obliged to peruſe and analyſe. This much I muſt be allowed to ſay, that, when I began the ſtudy of Natural Hiſtory, ſuch an analytical account of the writings on that ſubject, from Ariſtotle to the preſent time, would not only have been highly grateful, but would have ſaved me more time and ſtudy than I can deſcribe. If it ſhall be ſo fortunate as to facilitate the labours, or rather prevent young men from the neceſſity of undergoing the ſame labour, I ſhall be happy in the reflection, that I have at leaſt endeavoured to be uſeful to thoſe explorers of the wonderful works of that inſcrutable BEING who planned and executed what Man, who arrogantly ſtyles himſelf the LORD of CREATION, can never be able fully to unfold. Reflections of this kind, however, ſhould rather ſtimulate than depreſs the ſpirit of human inquiry.

CHAP.

CHAPTER II.

Of the Multiplication and Continuation of Species.

IN treating of this moſt intricate and delicate ſubject, I ſhall endeavour to avoid every idea that might lead to wantonneſs, or impropriety. No philoſophical inquiry into the wonderful operations of Nature, if expreſſed in irreproachable terms, can merit reprehenſion.

SECT. I.

Of the diviſion of Animals into viviparous and oviparous—Some Animals belong to neither of theſe diviſions.

THE idea of dividing animals into *Viviparous* and *Oviparous* muſt have been as antient as the exiſtence of human beings. But the diſcovery, that many of the ſmaller animals were endowed with the faculty of multiplying without the intervention of either of theſe modes of procreation was reſerved to a very modern age. This diſcovery was made partly by natural obſervation, but more extenſively by the aid of the microſcope. In the firſt volume of this work, I have given many examples of ſingular modes by which Nature has enabled particular animals to multiply their ſpecies [*]. It would, therefore, be ſuperfluous here to ſay more upon that ſubject.

SECT.

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[*] Vol. I. p. 30. et ſeq.

SECT. II.

An account of the principal Theories, both antient and modern, which have been publiſhed on this ſubject; particularly with regard to the larger Animals.

THE doctrine of equivocal generation, or the production of animated beings by a fortuitous commixture of inert and corrupted materials, though firmly believed by the antients, has of late been ſo completely refuted by Redi, and other unprejudiſed inveſtigators of the genuine operations of Nature, that it deſerves no farther notice.

§ I.—**Hippocrates**, who lived above five hundred years before Ariſtotle, taught an opinion upon this ſubject, which was adopted by Galen, and by moſt phyſicians for many ages. Hippocrates maintained the exiſtence of a female fluid, and even that both the male and the female had two fluids, the one ſtrong and active, the other weaker and leſs active *. A concurrence of the two ſtronger fluids, he remarks, produces a male, and of the two weaker, a female. This abſurd notion he endeavours to ſupport by obſerving, that ſeveral women, who produced girls only by their firſt huſband, have had boys by their ſecond; and that the ſame thing has often happened to men who have had two wives. Hippocrates next tells us, that the ſemen proceeds from every part of the body, and particularly from the head; becauſe, he remarks, thoſe who have had the veins behind their ears cut, ſecrete only a weak and often an unfertile ſemen. The female likewiſe ſheds a ſeminal fluid ſometimes within and ſometimes without the uterus. The ſemen of the male enters the uterus, and intermixes with that of the female; and, as each poſſeſſes two kinds of fluid, the one ſtrong and the other weak, if both of them furniſh the ſtrong kind, a male foetus is the conſequence; and, if both furniſh the weak kind only, the reſult is a female: Beſides, if in the mixture there are more particles of the male than of the female fluid, the child will reſemble the father more than the mother; *et e contra*.

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* Hippocrat. lib. de Genitura, p. 129. et lib. de Diaeta, p. 198. Lugd. Bat. tom. 1. 1665.

We ſhall now exhibit a ſhort account of Hippocrates's notion of the mode by which the foetus is formed. The ſeminal fluids, ſays he, firſt mix in the uterus, and gradually thicken by the heat of the mother. The mixture extracts the ſpirit of heat, and, when too warm, part of the heat eſcapes into the air. But a cold ſpirit is likewiſe conveyed to it by the reſpiration of the mother. Thus a cold and a hot ſpirit alternately enter the mixture, give life to it, and cover its ſurface with a pellicle, which aſſumes a round figure, becauſe the ſpirits, by acting in the center, expand the matter equally on all ſides. I have ſeen, this great philoſopher remarks, a foetus of ſix days old: It was a ball of liquor incloſed in a pellicle. The liquor was reddiſh; and the pellicle was interſperſed with red and colourleſs veſſels. In the middle of the liquor there was a ſmall eminence, which I imagined conſiſted of the umbilical veſſels, by which the foetus receives nouriſhment and the ſpirit of reſpiration from the mother. A ſecond covering or pellicle gradually forms above the firſt. Plenty of nouriſhment is furniſhed by the menſtrual blood, which coagulates and is converted into fleſh. This fleſh gradually articulates, and derives its form from the ſpirit. Every part aſſumes its proper ſtation; the ſolid parts unite; the moiſt particles aſſociate by themſelves; every thing ſearches for what is analogous to it; and, in fine, the foetus, by the operation of theſe cauſes, is completely formed.

§ 2.—The next theory we ſhall mention is that of the celebrated ARISTOTLE. After enumerating ſome varieties in the ſtructure and modes of multiplying exhibited to our obſervation by different ſpecies of animals, he examines the opinion of the more antient philoſophers, who maintained that the ſemen of both male and female was extracted from every part of the body. Ariſtotle diſſents from this opinion; becauſe, ſays he, though children often reſemble both father and mother, they ſometimes alſo reſemble their grandfathers. Beſides, they reſemble their parents in the voice, in the hair, in the nails, and in the gait and manner of walking. Now, proceeds our author, it is impoſſible for the ſemen to come from the hair, from the voice, from the nails, or from any external quality, as that of the mode of walking. Hence children reſemble not their parents becauſe the ſemen proceeds from all parts of the body. The ſeminal liquor of the male, Ariſtotle remarks, is ſecreted from the blood; and the menſtrual fluid of the female is likewiſe a ſecretion from the blood, and the only matter that contributes to generation. Females, he continues, have no other prolific fluid; no mixture, therefore, of male and female fluids take place. This he attempts to prove by obſerving, that ſome women conceive without any titillation; that few emit any fluid in coition; that, in general, thoſe who are brown, with a maſculine air, have no emiſſion, and yet their powers of procreation are not leſs than thoſe of a fairer complexion and more delicate appearance, who emit copiouſly. Thus, he concludes, women furniſh nothing for the purpoſes of generation, but the menſtrual blood. This blood is the matter of generation, and the male fluid contributes the form only. The male fluid is the efficient cauſe, and the chief principle of motion; it is to generation what the ſculptor is to a block of marble: The ſeminal fluid is the ſculptor, the menſtrual blood the marble, and the fœtus the figure. The male ſemen gives to the menſtrual blood both life and motion, or a kind of ſoul. This ſoul is neither material nor immaterial, becauſe it can neither act upon matter, nor augment the menſtrual blood, which is the only matter neceſſary to generation. It is a ſpirit, ſays our philoſopher, ſimilar to that of the element of the ſtars. The heart is the firſt production of this ſoul; which is the cauſe of its own growth, and of the growth and diſpoſition of all the other members. The menſtrual blood contains the *capacities* of all the parts of the fœtus; the ſoul or ſpirit of the male ſemen makes the heart begin to *act*, and communicates to it the powers of beſtowing action on the other viſcera; and, in this manner, the different parts of the animal are ſucceſſively unfolded.

Theſe two great men have had each their followers. Moſt of the ſcholaſtic philoſophers adopted Ariſtotle's theory of generation; but the ancient phyſicians, in general, adhered to the theory of Hippocrates. In this manner near eighteen centuries paſſed without the veſtige of any thing new concerning this myſterious ſubject. Upon the revival of literature, however, anatomiſts began to make reſearches into the nature of generation.

§ 3.—FABRICIUS AB AQUAPENDENTE firſt made a courſe of experiments upon the impregnation and expanſion of the eggs of fowls, the ſubſtance of which ſhall be laid before the reader. Fabricius diſtinguiſhes the matrix of a hen into two parts, the one ſuperior, the other inferior. The ſuperior part, which he calls the *ovarium*, contains an aſſemblage of a great number of ſmall yellow eggs, of a round figure, the ſizes of which vary from that of a muſtard ſeed to that of a walnut. Theſe eggs are attached to one another by foot-ſtalks, and the whole group has a reſemblance to a bunch of grapes.

After impregnation, an egg is detached from the common pedicle, and gradually deſcends, through a winding canal, into the inferior part of the matrix. The canal is filled with a liquor ſimilar to the white of an egg. In this canal the egg receives its white liquor, the membrane in which it is incloſed, the two cords (*chalazae*) that run through the white, and join it to the yolk, and the ſhell, which is ſuddenly formed before excluſion. Theſe cords, ſays Fabricius, are the part of the egg which is impregnated by the ſeminal ſpirit of the male; and it is here alſo that the rudiments of the fœtus firſt make their appearance. The egg is not only the true matrix, or the place where the fœtus is formed, but upon it the whole proceſs of generation depends. The egg is the great agent in generation; it furniſhes both the matter and the organs. The ſubſtance of the cords is the matter of which the chick is formed; the white and the yolk ſupply it with nouriſhment; and the ſeminal ſpirit of the male is the efficient cauſe. This ſpirit communicates to the cords, firſt, an alterant quality, then a forming quality, and, laſtly, a power of augmenting, &c.

§ 4.—HARVEY, our celebrated countryman, who, at ſo late a

period,

period, it is almoſt incredible to think, firſt diſcovered the circulation of the blood, has likewiſe given us an ingenious treatiſe on generation. He flouriſhed about the middle of laſt century, and was phyſician to Charles I. He alledges, that men, and all other animals, proceed from eggs; that, in viviparous animals, the firſt produce of conception is a kind of egg; and that the only difference between the viviparous and oviparous is, that, in the former, the fœtus begins to exiſt, increaſe, and arrive at its full growth while it remains in the uterus; but that, in oviparous animals, the fœtus begins to exiſt, when in the form of an egg, in the body of the mother, and it is only after excluſion and incubation, that it becomes a living animal. It farther deſerves to be remarked, ſays he, that, in oviparous animals, ſome retain their eggs till they be perfect, as birds, ſerpents, and oviparous quadrupeds; and that others exclude their eggs before they have arrived at maturity, as fiſhes, cruſtaceous, and teſtaceous animals. The eggs laid by theſe creatures are only the rudiments of eggs, which afterwards acquire membranes and a white, and attract nouriſhment from the matter with which they are ſurrounded. He adds, that there are inſects, caterpillars, for example, which are only imperfect eggs; they ſearch for and take nouriſhment, and, at the end of certain times, they arrive at the chryſalis ſtate, which is a perfect egg. Another difference is remarkable in oviparous animals: The eggs of hens, and of other birds, are of different ſizes, but thoſe of fiſhes, frogs, &c. who lay them before they are perfect, are all of the ſame ſize. He indeed obſerves, that, in pigeons, who lay two eggs, all the ſmall eggs, which remain in the ovarium, are of the ſame bulk; and that the two only which are next to be excluded exceed the ſize of the reſt. The ſame phænomenon takes place in cartilaginous fiſhes, as in the ray, which brings to maturity only two eggs at a time.

Harvey next deſcribes anatomically the parts neceſſary to generation; and he remarks, that the ſituation of the anus and vulva in birds differs from that of all other animals, the anus being placed before, and the vulva behind. Hens produce eggs without the intervention of the cock; but, though ſeemingly perfect, they are fewer in number, and totally unfertile. He credits not the common opinion, that a few days intercourſe with the cock are ſufficient to impregnate all the eggs which a hen ſhall lay during a whole year; but he acknowledges, that he ſeparated a hen from the cock for twenty days, and that all the eggs ſhe laid were fecundated.

The two cords (*chalazae*) which Fabricius ab Aquapendente conſidered to be the germ, or part produced by the male ſemen, are found in unimpregnated, as well as impregnated eggs; and Harvey juſtly remarks, that theſe parts neither proceed from the male, nor receive the impregnation. The part of the egg which receives the impregnation is a ſmall white circle ſituated upon the membrane that covers the yolk, and has the appearance of a cicatrice about the ſize of a lentil. Harvey likewiſe remarks, that this cicatrice is found in all eggs, whether they be fecundated or not; and that thoſe are deceived who imagine it to be produced by the ſemen of the male. It is of the ſame ſize and form in freſh eggs as in thoſe which have been long kept. But, as ſoon as the proceſs of hatching is begun, whether by artificial heat or by that of the hen, this ſmall mark or cicatrice gradually augments and dilates like the pupil of the eye. This is the firſt change, and it is viſible after a few hours of incubation. When the egg has been heated 24 hours, the yolk, which was formerly in the centre, riſes towards the cavity at the thick end of the egg. This cavity is occaſioned by the evaporation of the more fluid part of the white, the heavier part of which falls down to the ſmall end. The cicatrice or ſpeck on the membrane of the yolk is elevated along with it, and applies itſelf to the membrane which lines the cavity at the thick end. This ſpeck is now as large as a pea; and a white point is diſtinguiſhable in the middle of it, with ſeveral circles, of which that point appears to be the common centre.

At the end of the ſecond day, theſe circles are larger and more conſpicuous; and they divide ſometimes into two, and ſometimes into three parts, which are of different colours. A ſmall external protuberance likewiſe appears, nearly reſembling a little eye, with a white point or cataract on the pupil. Between the circles is contained a tranſparent liquor by means of a very thin membrane. The ſpeck, which is now become a ſmall liquid globe, appears as if it were ſituated in the white, rather than on the membrane of the yolk. On the third day, the tranſparent liquor, as well as the membrane in which it is incloſed, is conſiderably augmented. On the fourth day, a ſmall line of blood, of a purple colour, appears on the circumference of the liquid globe; and, at a little diſtance from the centre, we perceive a dot or point, of a bloody colour, which has pulſations like a heart. It is viſible at every diaſtole, and diſappears during the ſyſtole. Two ſmall blood-veſſels iſſue from this animated point, and terminate in the membrane which contains the tranſparent liquor. Theſe blood-veſſels ſet off from the ſame place nearly in the ſame manner as the roots of a tree ſet off from the trunk. It is in the angle which theſe roots form with the trunk, and in the middle of the liquor, that the animated point is ſituated.

About the end of the fourth, or beginning of the fifth day, the animated point is ſo much enlarged, that it has the appearance of a ſmall bladder filled with blood; and by its contractions and dilatations,

tions, it is alternately filled and emptied. On the ſame day, we perceive diſtinctly, that this bladder is divided into two parts, each of which dilates and contracts in the ſame manner. Round the ſhorteſt of the blood-veſſels mentioned above, a kind of cloud appears, which, though almoſt tranſparent, obſcures the view of the veſſel. This cloud becomes every hour thicker; it attaches itſelf to the root of the blood-veſſel, and ſeems to depend from it like a ſmall globe. This globe ſtretches out, and appears to divide into three parts, one of which is globular, and larger than the other two; and here we perceive the rudiments of two eyes, and of the whole head. At the end of the fifth day, in the remainder of this lengthened globe, the commencement of the vertebrae. On the ſixth day, the parts of the head are more apparent. We can diſtinguiſh the coats of the eyes, the thighs, and the wings; and then the liver, the lungs, and the beak. The foetus now begins to move and to ſtretch out its head, though, of the inferior parts, nothing but the viſcera are yet formed; for the thorax, the abdomen, and all the external coverings of the fore part of the body, are ſtill wanting. At the end of this day, or the beginning of the ſeventh, the claws begin to be viſible; the chick opens and moves its beak; and the anterior parts of the body begin to cover the viſcera. On the ſeventh day, the chick is entirely formed; and, from this time till it iſſues from the egg, nothing remarkable happens but a gradual expanſion of all the parts it had acquired during the firſt ſeven days. The feathers appear on the 14th or 15th day; and, on the 21ſt, the chick eſcapes from the egg, by breaking the ſhell with its bill.

Beſide theſe experiments upon eggs, Harvey made many others upon female deer. They receive the male about the middle of September.

tember. A few days afterwards, the *horns* * of the uterus appear to be thicker and more fleſhy than uſual. They are, at the ſame time, more flaccid; and, in each of their cavities, five carunculae, or ſoft warts, appear. About the 26th or 28th of September, the uterus is ſtill thicker; and the five carunculae are ſwelled nearly to the ſize and form of a nurſe's nipple. On opening them with a ſcalpel, they appeared to be filled with an infinite number of white points.

About the end of October, or the beginning of November, when the females were ſeparated from the males, the thickneſs of the *horns* began to diminiſh, and their internal ſurfaces were ſwelled, and ſeemed to be glued together. The carunculae ſtill remained; and the whole maſs reſembled the ſurface of the brain, being ſo ſoft that it could not be touched without derangement. Harvey farther informs us, that on the 13th or 14th of November, he perceived thin filaments, like thoſe of a ſpider's web, which traverſed the cavities of the *horns*, and even that of the uterus itſelf. Theſe filaments derived their origin from the ſuperior angle of the *horns*, and, by their number, formed a kind of membrane or empty ſac. A day or two afterwards, this ſac was filled with a white, aqueous, viſcid matter, which adhered to the uterus by a ſpecies of mucilage; and the adheſion was moſt apparent at the ſuperior part of the uterus, where the rudiments of the placenta began then to appear. In the third month, this ſac contained an embryo about an inch and a half in length, and likewiſe an internal ſac, called the *amnios*, incloſing a tranſparent cryſtalline liquor, in which the foetus ſwam. At firſt, the foetus was only an animated point, like that which appeared in the hen's egg.

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* Two fleſhy proceſſes, one of which iſſues from each ſide of the *fundus uteri*, in the from of little *horns*, and are remarkable in ſome quadrupeds.

Every thing now proceeded and terminated in the ſame manner as deſcribed with regard to the chick, with this difference only, that the eyes of the chick appeared much earlier than thoſe of the deer. About the 19th or 20th of November, the animated point was viſible. A day or two afterwards, the oblong body, which contained the rudiments of the foetus, made its appearance. In ſix or ſeven days more, the foetus was ſo completely formed, that all its members, and even its ſex, were diſtinguiſhable. But the heart and viſcera were ſtill bare; and it was not till a few days after, that they were covered with the abdomen and thorax. This, Harvey remarks, is the laſt work, and the ſlating of the edifice.

From his experiments upon hens and deer, Harvey infers, that all female animals have eggs; that, in theſe eggs, a ſeparation of a tranſparent cryſtalline liquor, contained in a ſac (*amnios*), takes place, and that another external ſac (*chorion*) incloſes the whole fluids of the egg; that, in the cryſtalline liquor, the firſt object which appears is an animated ſanguineous point; and, laſtly, that the original formation of viviparous animals is effected in the ſame manner with that of the oviparous. Harvey farther concludes, that generation is an operation of the uterus alone; for not a drop of the male ſemen ever enters that organ. The uterus, he aſſerts, conceives by a kind of contagion communicated to it by the ſemen of the male, in the ſame manner, nearly, as the load-ſtone communicates a magnetic virtue to iron. This male-contagion acts not only on the uterus, but on the whole body of the female, which is entirely fecundated, though the uterus alone poſſeſſes the faculty of conception, in the ſame manner as the brain has the ſole power of conceiving ideas. The ideas, or impreſſions, conceived by the brain, are ſimilar to the images of the objects tranſmitted to it by the ſenſes; and the foetus, which may be conſidered as the idea of the uterus, is ſimilar to that by which it is produced. Hence the reaſon why children reſemble their fathers, &c.

§ 5.—About fifty years after the trials of Harvey, Malpighius* carefully examined the cicatrice, which is the moſt eſſential part of an egg: He found that it was large in impregnated eggs, and ſmall in thoſe which had received no impregnation. He likewiſe diſcovered, that, in eggs which had never been ſat upon, the white point mentioned by Harvey as the firſt part that aſſumes animation, is a ſmall purſe or bubble ſwimming in the liquor bounded by the firſt circle; and that the embryo is viſible in the centre of this purſe. The membrane of the purſe, which is tranſparent, allowed him to ſee diſtinctly the fœtus within it. Malpighius, from this firſt obſervation, concludes with propriety, that the foetus exiſts in the egg before incubation, and that the rudiments of the embryo are even then deeply rooted. After aſcertaining this important fact, Malpighius proceeded to examine the cicatrice of unimpregnated eggs, which is ſmaller than in thoſe which had received an impregnation. Near the centre of the cicatrice, inſtead of a bubble including the foetus, there is a globular mole or unorganized maſs, which, when opened, exhibits nothing like regularity or arrangement of parts: It has only ſome appendages filled with a viſcid but tranſparent liquor; and this unformed maſs is enveloped in ſeveral concentric circles.

After ſix hours incubation, however, the cicatrice is conſiderably enlarged; and, in its centre, a bubble or globule, formed by the amnios,

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* Malpighii pullus in ovo.

nios, is eaſily diſtinguiſhed. This globule is filled with a fluid, in the middle of which the head and back-bone of the chick are viſible. Six hours afterwards, the parts are all enlarged, and, of courſe, more apparent. In ſix hours more, that is, eighteen hours from the commencement of incubation, the head is larger, and the ſpine is lengthened; and, at the end of twenty-four hours, the head has acquired a bended poſture, and the ſpine is of a whitiſh colour. The vertebrae are ranged on each ſide of the ſpine, like ſmall globules; and, about the ſame time, the wings begin to ſhoot, and the head, neck, and breaſt are lengthened. At the end of thirty hours, nothing new appears, except that all the parts are enlarged, and particularly the amnios. Around this membrane, we can perceive the umbilical veſſels, which are of a dark colour. In thirty eight hours, the head of the chick is very large, and three veſicles appear in it ſurrounded with membranes, which likewiſe include the ſpine of the back, through which, however, the vertebrae are ſtill viſible. At the end of forty hours, it was admirable to obſerve, continues our author, the chick living in the centre of the liquor contained in the amnios. The back-bone was increaſed, the head was bended, the veſicles of the brain were leſs bare, the rudiments of the eyes appeared, the heart beat, and the blood circulated.

At the end of the ſecond day, the foetus appeared ſwimming in the liquor of the amnios; the head, which appeared to be compoſed of veſicles, was bended; the back-bone and vertebrae were lengthened; the heart, which hung out of the breaſt, always beat three times ſucceſſively, becauſe the fluid it contains is puſhed from the auricle into the ventricles, from the ventricles into the arteries, and, laſtly, into the umbilical veſſels. In fourteen hours more, or ſixty-two hours from the beginning of incubation, the chick, though ſtronger, remained ſtill with its head bended in the liquor of the amnios: Veins and arteries were perceived in the brain; and the rudiments of the eyes, and of the ſpinal marrow, appeared. At the end of three days, the body of the chick was crooked. Beſide the two eyes, five veſicles filled with liquor were ſeen in the head; the rudiments of the thighs and of the wings were diſcerned; the body began to aſſume fleſh; and the pupils of the eyes, and likewiſe the cryſtalline and vitreous humours, were diſtinguiſhable. At the termination of the fourth day, the veſicles of the brain were nearer each other; the proceſſes of the vertebrae were longer; the wings and the thighs had become ſtronger in proportion as they grew longer; the whole body was covered with a gelatinous fleſh; the umbilical veſſels had pierced through the abdomen; and the heart was incloſed by a thin tranſparent membrane. On the fifth, and at the end of the ſixth day, the veſicles of the brain began to be covered; the ſpinal marrow, which was now more ſolid, was divided into two parts, and advanced along the trunk; the thighs were longer, and the wings were unfolded; the abdomen was ſhut and tumified; the liver was diſtinctly viſible, and of a dark colour; the two ventricles of the heart beat; the body of the chick was covered with ſkin; and the points of the feathers began to appear. On the ſeventh day, the head was very large; the brain was covered with its membranes; the beak appeared between the two eyes; the wings, the thighs, and the legs, had acquired their perfect form; the heart ſeemed to be compoſed of two ventricles, like two contiguous globules, united at their ſuperior part with the auricles; and two ſucceſſive pulſes were remarked both in the ventricles and auricles, as if there had been two ſeparate hearts.

§ 6.—We ſhall now give a ſhort account of De Graaf's experiments upon rabbits. He diſſected a female rabbit half an hour after copulation. The horns of the uterus, he remarks, were uncommonly red. No change had taken place in the ovaria, nor in the eggs which they contained; and there was not a veſtige of ſemen in the vagina, in the uterus, or in the Fallopian tubes. Six hours after copulation, he diſſected another rabbit; and obſerved that the follicles, which, in his eſtimation, contain the eggs in the ovarium, were become red; but he found no ſemen either in the ovaria or any where elſe. Twenty hours after copulation, he diſſected a third rabbit; and remarked in one ovarium three, and in the other five follicles much altered; for, inſtead of being clear and limpid, they were opaque and reddiſh. In another, diſſected twenty-ſeven hours after copulation, the horns of the uterus, and the ſuperior canals which terminate in them, were ſtill more red, and their extremities embraced the ovarium on all ſides. In another, opened forty hours after copulation, he found in one ovarium ſeven, and in the other three follicles charged. Fifty-two hours after copulation, he examined another, and diſcovered in one ovarium four charged follicles, and one in the other. Having opened theſe follicles, he diſcovered in them a kind of glandular liquor, with a ſmall cavity in the middle, in which he could perceive no fluid. This circumſtance led him to ſuſpect that the tranſparent liquor, uſually contained in the follicles, might have been diſcharged by ſome rupture of the membranes. He ſearched in vain for this matter in the canals which terminate in the horns of the uterus, and in the horns themſelves. He remarked, however, that the membranes which line the horns of the uterus were much ſwelled. In another rabbit, diſſected three days after copulation, he obſerved, that the ſuperior extremity of the canal, which terminates in the horns of the uterus, ſtraitly embraced each ſide of the ovarium; and, after ſeparating it from the ovarium, he perceived, in the right ovarium, three follicles ſomewhat larger and harder than uſual. After carefully ſearching the canals formerly mentioned, he tells us, that he diſcovered an egg in the right canal, and two more in the right horn of the uterus; but they exceeded not the ſize of muſtard ſeeds. Theſe little eggs had each two membranes, of which the internal one was filled with a limpid liquor. Upon examining the other ovarium, he found four charged follicles; three of them were whiter, and had ſome limpid fluid in their centres; but the fourth was of a darker colour, and contained no liquor, which made him ſuſpect that the egg had deſcended. He therefore ſearched the correſponding canal and horn of the uterus, and found an egg in the ſuperior extremity of the horn, which was exactly ſimilar to thoſe he had diſcovered in the right horn. He ſays, that the eggs, when ſeparated from the ovarium, are ten times ſmaller than before their ſeparation. The difference in ſize, he imagines, is owing to this circumſtance, that the eggs, while in the ovarium, contain another matter, namely, the glandulous liquor which he remarked in the follicles.

He opened another rabbit, four days after copulation, and he found in one ovarium four, and, in the other, three follicles void of eggs. In the horns of the uterus correſponding to the ovaria, he found four eggs in the one, and three in the other. Theſe eggs were larger than thoſe he had diſcovered three days after copulation. They were nearly as large as the lead uſed for ſhooting ſmall birds; and he remarked, that, in theſe eggs, the interior membrane was ſeparated from the exterior, and the whole appeared as if a ſecond egg was contained within the firſt. In another rabbit, diſſected five days after copulation, he found five empty follicles in the ovaria, and the ſame number of eggs in the uterus, to which they firmly adhered. Theſe eggs were as large as the ſhot employed for killing hares, and the internal membrane was ſtill more apparent than in the laſt experiment. Six days after copulation, he opened another rabbit; and, in one of the ovaria, found ſix empty follicles, but five eggs only in the correſponding horn of the uterus, and they ſeemed to be all accumulated into one maſs: In the other ovarium, he ſaw four empty follicles, and found but one egg in the correſponding horn. Theſe eggs were of the ſize of the largeſt fowling ſhot. Our anatomiſt opened another rabbit ſeven days after copulation, and found in the ovaria ſome empty follicles, which were larger, harder, and more red than thoſe he had formerly obſerved. He perceived as many tranſparent tumors in different parts of the uterus. Having opened theſe tumors, he took out the eggs, which were as large as ſmall piſtol bullets. The internal membrane was now more diſtinct than formerly; and within this membrane he ſaw nothing but a very tranſparent liquor. In another rabbit, diſſected eight days after copulation, he found in the uterus the tumors or cells which contain the eggs; but they adhered ſo firmly to the uterus, that he could not detach them. Nine days after copulation, he found the cells containing the eggs greatly enlarged, and perceived in the middle of the liquor incloſed by the internal membrane a thin ſmall cloud. Ten days after copulation, he found, in another rabbit, that the ſmall cloud was thicker and darker, and formed an oblong body reſembling a little worm. Twelve days after copulation, he perceived diſtinctly the embryo, which was now ſo apparent, that he could diſtinguiſh its different members. He ſaw, in the region of the breaſt, two red and two white points, and, in the abdomen, a reddiſh mucilaginous ſubſtance. The head of the fœtus, fourteen days after copulation, was large and tranſparent; the eyes were prominent;

nent; the mouth was open; the ears began to appear; the backbone was whitiſh, and bended towards the ſternum. From each ſide of the ſpine, ſmall blood-veſſels aroſe, the ramifications of which extended along the back as far as the legs. The two red points were now conſiderably enlarged, and ſeemed to be the rudiments of the two ventricles of the heart. On each ſide of the red points he ſaw two white ones, which were the rudiments of the lungs. In the abdomen, he perceived the rudiments of the liver, which was reddiſh, and a ſmall body twiſted like a thread, which was the ſtomach and inteſtines. After this, till the 31ſt day, when the female rabbit brings forth, nothing was to be remarked but the gradual expanſion and growth of the parts which had already been formed.

De Graaf, from theſe experiments, concludes, that all viviparous animals have eggs; that theſe eggs are contained in the ovaria or teſticles; that they cannot be detached till they are fecundated by the male ſemen; becauſe, he remarks, the glandular liquor, by means of which the eggs are enabled to eſcape from their follicles, is not ſecreted till after impregnation. He alledges that thoſe who imagine they have ſeen pretty large eggs in three days have been deceived; becauſe, in his eſtimation, the eggs, though fecundated, remain longer in the ovarium, and, inſtead of augmenting, become ten times leſs than formerly, and never begin to grow till after their deſcent from the ovaria into the uterus.

This pretended diſcovery of eggs in the teſticles of females attracted the attention of many anatomiſts. In the teſticles of viviparous females, however, they found only ſmall bladders, which they did not heſitate to conſider as real eggs; and, therefore, they called the teſticles *ovaria*, and the veſicles *eggs*. They likewiſe aſſerted, that the ſize of theſe eggs differed in the ſame ovarium; that the largeſt in the ovaria of women did not exceed the bulk of a ſmall pea; that they are very minute in young girls; but that they increaſe with age and intercourſe with men; that not above 20 could be diſcovered in each ovarium; that theſe eggs are fecundated in the ovarium by the ſpiritous part of the male ſemen; that, after impregnation, they ſeparate, and fall into the uterus through the Fallopian tubes; that the fœtus is formed of the internal ſubſtance of the egg, and the placenta of its external part; that the glandulous matter, which does not exiſt in the ovarium till after a fruitful embrace, compreſſes the egg, and forces it to part from the ovarium, &c.

But, of all anatomiſts, Malpighius and Valiſnieri ſeem to have written with moſt judgment upon this intricate ſubject. Malpighius, after examining the teſticles of many cows and other female animals, aſſures us, that he found in all of them veſicles of different ſizes, whether the females were very young, or adults. Theſe veſicles are incloſed in a membrane, the inſide of which is interſperſed with blood-veſſels; and the veſicles are filled with a kind of lymph or liquor, which, like the white of an egg, coagulates and hardens when expoſed to the heat of a fire. In proceſs of time, a firm yellow body adheres to the teſticles. It is prominent, increaſes to the ſize of a cherry, and occupies the greateſt part of the ovarium. This body conſiſts of ſeveral angular lobes, the poſition of which is very irregular, and it is covered with a membrane interſperſed with nerves and blood-veſſels. When the yellow body exceeds not the ſize of a grain of millet, it is roundiſh, and its ſubſtance, when cut, has a warty appearance. When it has acquired nearly the ſize of a pea, it is ſhaped like a pear; and, in its centre, there is a ſmall cavity filled with liquor. In ſome of theſe yellow bodies, after they

have

have come to maturity, Malpighius aſſerts, that, in the yellow bodies, he ſaw, near the centre, a ſmall egg, about the ſize of a millet ſeed; and that, after they had diſcharged the eggs, theſe bodies became empty and flaccid. He ſuppoſed that Nature deſigned this yellow glandulous body for the preſervation of the egg, and for making it eſcape from the teſticles; and, perhaps, he remarks, it contributed to the formation of the egg; and, conſequently, he concludes, that the veſicles, which are at all times found in the ovarium, and always differ in ſize, are not the real eggs which receive the impregnation, but only ſerve to produce the yellow bodies in which the eggs are formed. Beſides, though theſe yellow bodies are not uniformly found in every ovarium; yet the rudiments of them are always apparent. Malpighius found the marks of them in new born heifers, in cows with calf, and in pregnant women; and, therefore, he concludes, that theſe yellow glandular bodies are not, as alledged by De Graaf, a reſult of impregnation. The yellow bodies, he remarks, produce unfecundated eggs, which fall out of the ovarium independent of any communication with the male, as well as thoſe which fall after impregnation. When impregnated eggs fall into the uterus, every thing proceeds in the manner which De Graaf has deſcribed.

§ 7.—We ſhall now give an abridged view of the remarks of Valisnieri, a diſciple of Malpighius. In the year 1692, he began his experiments upon the teſticles of the ſow, which differ from thoſe of cows, of mares, of ſheep, and of moſt other viviparous animals; for they reſemble a ſmall bunch of raiſins, the grains of which are round and prominent. Between theſe grains are ſmaller ones, not yet arrived at maturity. Theſe grains ſeem not to be covered with any common membrane. They are, he remarks, analogous to the yellow bodies obſerved by Malpighius in cows; they are round, and of a reddiſh colour; their ſurface is interſperſed with blood-veſſels; and the whole grains form a maſs which is larger than the ovarium.

In every ſow, the glandular bodies are not of the ſame colour. In ſome, they are more red; in others more clear; and their ſizes vary from that of the ſmalleſt ſeed, to that of a raiſin. When opened, a triangular cavity appears; it is filled with a limpid liquor, which coagulates with heat, and becomes white, like that contained in the veſicles. Valiſnieri expected to find eggs in ſome of theſe cavities. But this expectation was diſappointed; for, though he carefully ſearched all the glandular bodies of a number of ſows, and other animals, he could never diſcover the egg, which Malpighius ſays he once or twice found. Under theſe glandular bodies, the veſicles of the ovarium appeared, which were more or leſs numerous according as the glandular bodies were larger or ſmaller; for, in proportion to the largeneſs of the glandular bodies, the veſicles diminiſhed. Some veſicles were of the ſize of a lentil, and others did not exceed that of a millet ſeed. In the teſticles, when raw, from twenty to thirty-five veſicles might be reckoned; but, when boiled, a much greater number appear; and they are ſo firmly attached, that they cannot be ſeparated without breaking ſome of them. In the teſticles of a young ſow, which had never been impregnated, he found, as in the others, glandular bodies; their triangular cavities were likewiſe filled with lymph; but no eggs could he diſcover in either of them. The veſicles of this young ſow were more numerous than in thoſe which had brought forth, or in thoſe which were impregnated previous to the time of examination. In the teſticles of another ſow, which was far advanced in pregnancy, Valiſnieri found two of the largeſt glandular bodies, which were flaccid and empty, and others, of a ſmaller ſize, in their uſual ſtate. In others, which he diſſected when with young, he obſerved, that the number of glandular bodies always exceeded that of the foetuſes.

Valiſnieri, after his experiments upon ſows, repeats thoſe of Malpighius upon cows, and found them to be exactly conformable to truth, with this exception that he was never able to diſcover the egg which Malpighius imagined he had ſeen in the interior cavity of the glandular bodies. The experiments of Valiſnieri are not only numerous but accurate. Among other animals, he examined the ewe, and diſcovered, that ſhe has never a greater number of glandular bodies in her teſticles than of foetuſes in the uterus. In young ewes which had never been impregnated, there is but one glandular body in each teſticle; and, when one is emptied, another ſucceeds. This glandular body occupies the greateſt part of the teſticle; and, after it is emptied and diſappears, another begins to anſwer the purpoſes of a future generation. In the teſticles of a ſhe-aſs, he found veſicles as large as cherries. The teſticles of female wolves, dogs, and foxes, are covered with a membrane, like a purſe. In a bitch which began to be in ſeaſon, but had not been approached by the male, Valiſnieri found the internal of this moiſtened with a liquor that reſembled whey, and two glandular bodies in the right teſticle, which occupied nearly the whole extent of the teſticle. In each glandular body was a ſmall nipple, with a fiſſure, from which, without preſſing it, a liquor reſembling clear whey iſſued; he therefore concluded, that this liquor was the ſame which he found in the purſe. Into this fiſſure he blew with a pipe, and the whole glandular body ſwelled. He opened the body, and found an internal cavity which communicated with the nipple, and contained a conſiderable quantity of liquor. Valiſnieri was always in hopes that he would diſcover the egg; but, notwithſtanding all his reſearches, his hopes were uniformly fruſtrated. He diſſected another bitch four or five days after receiving the male, and found in the teſticles three glandular bodies perfectly ſimilar to the former. He every where ſearched for the egg, but was ſtill diſappointed. He diſcovered, by means of the microſcope, the glandular bodies to be a net-work compoſed of an infinite number of globular veſicles, which ſerved to filter the liquor that iſſued from the nipple.

Valiſnieri then opened another bitch which was not in ſeaſon; and, after trying to introduce air between the teſticle and the purſe, he found that it dilated like a bladder. Having removed the purſe, he diſcovered two glandular bodies on the teſticles; but they had neither nipple nor fiſſure, and no liquor diſtilled from them. In another bitch, that, two months before, had brought forth five whelps, he found five glandular bodies; but they were much diminiſhed in ſize, and began to diſappear without leaving any cicatrices. A ſmall cavity only remained in their centre, but it contained no liquor.

After theſe and many other ineffectual diſſections made upon a great variety of quadrupeds, Valiſnieri was deſirous of examining the teſticles of women. A young country-woman, who had been ſeveral years married, and was killed by a fall, afforded him the firſt opportunity. Though of a vigorous conſtitution, ſhe had never born any children. He endeavoured to diſcover whether the cauſe of her barrenneſs exiſted in the teſticles; and he found that all the veſicles were filled with a blackiſh corrupted matter. In a girl of eighteen years of age, who had been educated in a convent, and had every mark of virginity, he found the right teſticle a little longer than the left: Its figure was oval, and its ſurface was ſomewhat unequal. This inequality was occaſioned by five or ſix veſicles which protruded on the outſide of the teſticle. One of theſe veſicles, which was more prominent than the reſt, he opened, and a quantity of lymph ruſhed out. A glandular ſubſtance, in the form of a creſcent, and of a reddiſh yellow colour, ſurrounded this veſicle. He cut the teſticle tranſverſely, and found a number of veſſels filled with limpid liquor; and he remarked, that the Fallopian tube of this teſticle was redder and ſomewhat longer than the other, as he had frequently obſerved in other animals, when in ſeaſon. In a girl, aged five years, he found the teſticles with their veſicles, their blood-veſſels, and their nerves. In the teſticles of a woman of ſixty years, he diſcovered ſome veſicles, and the veſtiges of a glandular ſubſtance.

Valiſnieri, from theſe experiments and obſervations, infers, that the work of generation is carried on, and brought to perfection, in the female teſticles, which he perſiſted in regarding as ovaria, though he never could find eggs in them. He likewiſe remarks, that, for the impregnation of the egg, it is not neceſſary that the male ſemen ſhould enter the uterus. He imagines, that the egg, after being impregnated in the ovarium, eſcapes through the nipple of the glandular body; that it then falls into the Fallopian tube; and that it gradually deſcends, and at laſt attaches itſelf to the uterus. The ſpirit of the male ſeed, in his eſtimation, aſcends into the ovarium, penetrates the egg, and gives life and motion to the foetus which previouſly exiſted in it.

This ſyſtem of eggs, though it elucidates no branch of the ſubject, and probably has no foundation in Nature, would have received the univerſal aſſent of phyſicians, if, nearly about the ſame time, another hypotheſis had not ſolicited attention: It was founded upon the diſcovery of ſpermatic animalcules by means of the microſcope.

§ 8.—THIS diſcovery, which we owe to **LEUWENHOEK** and **HARTSOEKER**, was confirmed by Andrii, Valiſnieri, Bourguet, and many other philoſophers, and diligent obſervers. In male ſemen, the number of animalcules is ſo great, that it ſeems to be entirely compoſed of them; and Leuwenhoek tells us, that he ſaw many millions of them in a drop leſs that the ſmalleſt grain of ſand. Though none of them appear in females, they are found in the ſemen of all males, both in the teſticles, and in the veſiculae ſeminales. When ſemen is expoſed to a moderate heat, it thickens, and the movements of all the animalcules are ſuddenly ſtopped. But, when allowed to cool, it dilutes, and the animalcules continue to move till the liquor again thickens by evaporation. In proportion to the dilution of this fluid, the number of animalcules is augmented; and, when greatly diluted by the addition of water, the whole ſubſtance of the fluid ſeems to be compoſed of animals. When, by heat, or by drying, the motion of the animalcules is about to ceaſe, they ſeem to make a nearer approach to each other, to have a common circular motion in the centre of the ſmall drop under obſervation, and to periſh, all of them, at the ſame inſtant. But, when the quantity of liquor is greater, it is eaſy to perceive them dying in ſucceſſion. Theſe animalcules have been ſaid to be of different figures; but they are all oblong, thin, without any members, and move with rapidity in every direction.

Having examined the ſemen of a cock, Leuwenhoek perceived a number of animals ſimilar to river eels, which were ſo minute, that 50,000 of them were not equal in bulk to a grain of ſand. Of the animalcules in the ſemen of a rat, it required, he ſays, many millions to make the thickneſs of a hair. Leuwenhoek, from his numerous obſervations, was perſuaded that the whole ſubſtance of the ſemen was only a congeries of animalcules. He ſaw theſe animalcules in the ſemen of men, of quadrupeds, of birds, of fiſhes, and of inſects. In the ſemen of a man and that of a dog, he imagined he ſaw two ſpecies of animalcules, reſembling males and females. He opened a bitch which, ſome time before the experiment, had three times received the ſame dog. He could not perceive, with the naked eye, any male ſemen in the uterus or its appendages; but, by the aid of the microſcope, he found the ſpermatic animals of the dog in both horns of the uterus; which evidently proves, he remarks, that the male ſemen enters the uterus, or, at leaſt, that the ſpermatic animals of the dog had arrived there by their own motion, which enables them to paſs over the ſpace of four or five inches in half an hour.

Theſe and many other experiments of Leuwenhoek were repeated by ſeveral obſervers, who found them, in general, exactly conſonant to truth. Daleppatius, however, and ſome others, who were inclined to exceed Leuwenhoek in acuteneſs of viſion, alleged that, in the ſemen of a man, they diſcovered not only animals reſembling tadpoles, but Daleppatius inſiſts, that he ſaw one of theſe animals break through its coat or covering: It was then, ſays he, no longer an animalcule, but a real human body, in which he eaſily diſtinguiſhed the two arms and legs, the breaſt and the head. Daleppatius believed that he ſaw what he deſcribes; but he deceived himſelf; for this embryo, according to his account, was more completely formed, at the time of its tranſmigration from the ſtate of a ſpermatic worm, than it is in the womb of the mother at the end of the fourth or fifth week.

It is alleged by M. Andry, that he could diſcover no animalcules in human ſemen previous to the age of puberty; that they exiſt not in the ſemen of very old men; that there are few of them in thoſe who are affected with the venereal diſeaſe, and that thoſe few are in a languiſhing ſtate; that none of them appear to be alive in impotent perſons; and that the animalcules in the ſemen of men have a larger head than thoſe of other animals, which correſponds, he remarks, with the figure of the foetus and infant.

Leuwenhoek, Andry, and many others, exerted every effort to diſcredit the egg-ſyſtem. They diſcovered living animalcules in the ſemen of all males; they inſiſted that theſe animalcules could not be conſidered ſimply as inhabitants of this fluid, ſince the quantity of them was larger than that of the fluid itſelf, and ſince nothing ſimilar to them was to be perceived either in the blood, or in any other of the animal fluids: They maintained, that, as females furniſhed no animalcules, their fecundity was ſolely derived from the males; that the exiſtence of living animals in the ſemen threw more light upon the nature of generation than all the former diſcoveries on this intereſting ſubject; becauſe the greateſt difficulty in accounting for generation is to conceive how life is firſt produced, the future expanſion and growth of the parts being only acceſſory operations; and, conſequently, not a doubt could remain, that theſe animalcules are deſtined by Nature to become men, or perfect animals, according to the ſpecies.

It was not the firſt woman, according to this ſyſtem, but the firſt man, who contained the germs of the whole human race in his own body. The pre-exiſtent germs are no longer inanimate embryos locked up in eggs, and included, *in infinitum*, within each other. On the contrary, they are ſmall animals, or organized living *homunculi*, included in each other in endleſs ſucceſſion, and who, to make them men, or perfect animals, require nothing but expanſion of parts, and a transformation ſimilar to that of caterpillars when changed into winged inſects.

We have now pretty fully explained the two more modern ſyſtems, or rather theories, of the generation of animals, namely, the ſyſtem of eggs, and that of ſpermatic worms.

Neither of theſe ſyſtems received the aſſent of the celebrated **Count de Buffon.** Both ſyſtems, he remarks, ſuppoſe an infinite progreſſion, which is a mere illuſion of the brain. A ſpermatic worm, ſays he, is a thouſand million of times ſmaller than a man. If, therefore, the body of a man be aſſumed as a unit, that of a ſpermatic worm will be expreſſed by the fraction $\frac{1}{1,000,000,000}$, a number which conſiſts of ten cyphers. But, as man is to a ſpermatic worm of the firſt generation in the ſame proportion as this worm is to a worm of the ſecond generation, the ſize of this laſt ſpermatic worm will be expreſſed by a number conſiſting of nineteen figures. In this fanciful calculation, he proceeds to the ſixth generation, which would require to be expreſſed by fifty-five cyphers. But, if this calculation, he continues, were carried on to the ſixteenth generation, the minuteneſs would exceed all the powers of expreſſion. Hence, he concludes, the probability of this hypotheſis vaniſhes in proportion as the object diminiſhes. The ſame calculation applies equally to eggs as to ſpermatic worms; and the want of probability is common to both. Every hypotheſis which admits of an infinite progreſſion ought to be rejected not only as falſe, but as deſtitute of every veſtige of probability; and, as both the vermicular and ovular ſyſtems ſuppoſe an infinite progreſſion, they ſhould be for ever baniſhed from philoſophical ſpeculation, as well as from phyſiological diſcuſſion. Theſe ſyſtems, he proceeds, are liable to another objection. In the ovular ſyſtem, the firſt woman contained both male and female eggs. The male eggs could produce males only. But the female eggs muſt have contained millions of generations both of males and females. Hence every woman muſt have always poſſeſſed a certain number of eggs capable of being unfolded *in infinitum*, and another number, which could be unfolded once only, and could have no farther operation in the ſeries of exiſtence. The ſame obſervations are applicable to the vermicular ſyſtem. Hence, he concludes, that there is not the ſmalleſt degree of probability in either hypotheſis.

Another difficulty, continues our author, ſtill remains. It ariſes from the reſemblance of children ſometimes to the father, ſometimes to the mother, and ſometimes to both, and from the evident mongrel characters diſcoverable in mules and other irregular productions. If the foetus originates from the ſpermatic worm of the father, how ſhould the child reſemble its mother? If the foetus pre-exiſts in the egg of the mother, how ſhould the child reſemble its father? And, if the ſpermatic worm of a horſe, or the egg of a ſhe-aſs, be the origin of the foetus, how ſhould the mule partake of the nature and figure of both the horſe and aſs?

The objections, our author continues, to the ovular ſyſtem are not leſs important. If the foetus exiſted in the egg previous to intercourſe of the male and female, why is not the foetus ſeen in the egg previous to impregnation as diſtinctly as after it? Malpighius always found the foetus in eggs which had received impregnation, and, in unimpregnated eggs, he could diſcover nothing in the cicatrice but an unformed mole or maſs. It is evident, therefore, that the foetus is never formed till the egg has been impregnated. Beſides, we not only cannot diſcover the foetus in eggs before the intercourſe of the ſexes, but we have not been able to demonſtrate the exiſtence of eggs in viviparous animals. Thoſe naturaliſts who imagine that the ſpermatic worm is a foetus incloſed in a coat, or covering, are at leaſt aſcertained of the exiſtence of ſpermatic worms. But thoſe who maintain that the foetus pre-exiſts in the egg, have no evidence of the exiſtence of the egg itſelf; for the probability of their non-exiſtence in viviparous animals amounts almoſt to a certainty. Though the ſupporters of the ovular ſyſtem agree not as to what ought to be regarded as real eggs in female teſticles, they all admit, however, that impregnation is accompliſhed in the teſticles or ovaria. But they do not conſider, that, if this really happened, moſt foetuſes would be lodged in the abdomen, inſtead of the uterus? for, the ſuperior extremity of the Fallopian tube being unconnected with the ovarium, the ſuppoſed eggs would generally fall into the abdomen. This is well known to be a very rare phenomenon; and it is probable that it never happens but by ſome violent accident.

M. Mery, in the hiſtory of the Academy of Sciences, ſtated ſome objections to the egg-ſyſtem of generation. This dextrous anatomiſt inſiſts, with much propriety, that the veſicles found in the teſticles of females are not eggs; that they adhere ſo firmly to the internal ſurface of the teſticle, as not to admit of a natural ſeparation; and that, though they could ſeparate from the ſubſtance of the teſticle, it was impoſſible for them to eſcape from it, becauſe the texture of the common membrane which incloſes the whole teſticle is ſo ſtrong, that no man can conceive the poſſibility of its being pierced by a veſicle or gelatinous egg. As moſt anatomiſts and phyſicians were prepoſſeſſed in favour of the egg-ſyſtem, and imagined that the number of cicatrices in the ovaria correſponded with the number of foetuſes, M. Mery demonſtrated ſuch a quantity of theſe cicatrices in the teſticles of a woman, as, upon the ſuppoſition of the truth of this ſyſtem, would have implied a fecundity beyond all the powers of credibility. Other anatomiſts of the Academy, ſtimulated by theſe difficulties, made new reſearches. M. Duverney examined the teſticles of cows and ſheep, and maintained, that the veſicles were eggs, becauſe ſome of them adhered to the teſticles leſs firmly than others; and he ſuppoſed that they ſeparated entirely when they arrived at maturity. M. Mery replied, that this reaſoning was not ſatisfactory, becauſe theſe veſicles were never ſeen ſeparate from the teſticles. M. Duverney obſerved the glandular bodies upon the teſticles. He, however, never regarded them as parts eſſential to generation, but as accidental excreſcences, like gall-nuts on the leaves of the oak. M. Littre, whoſe prejudices were equally ſtrong in favour of the egg-ſyſtem, maintains, not only that the veſicles are eggs, but aſſures us, that he diſcovered in one of them a well-formed foetus, of which he could diſtinguiſh both the head and the trunk; and he has even ventured to give their dimenſions. From his own deſcription, however, it appears that the uterus was ſchirrous, that the teſticle was very much corrupted; and that the veſicle, or egg, which contained this pretended foetus, was ſmaller than uſual, &c.

We are told by Nuek, that he opened a bitch three days after copulation; that he drew out one of the horns of the uterus, and tied it in the middle, to prevent all communication with the ſuperior and inferior parts of the Fallopian tube. He then replaced the horn of the uterus, and cloſed the wound. In twenty-four days afterwards, he again opened the wound, and found two foetuſes in the ſuperior part of the tube, that is, between the teſticles and the ligature; and no foetus was to be ſeen in the under part. In the other horn of the uterus, upon which there was no ligature, he found three foetuſes. This fact proves, ſays he, that the foetus does not originate from the male ſemen, but that it exiſts in the egg of the female. This experiment is ſingle; but, though it had been often repeated, and followed with the ſame event, the concluſion drawn from it is illegitimate. It proves no more than that a foetus may be formed in the ſuperior as well as in the inferior part of the horn of the uterus.

I have now laid before the reader a ſhort hiſtorical account of the theories and obſervations of the moſt reſpectable authors, both antient and more modern, who have written upon the important, but obſcure ſubject of the multiplication and ſucceſſion of animated beings. I ſhall, therefore, proceed to give the ideas of ſome of our contemporaries.

§ 9.—BUFFON's experiments and reaſonings on the nature of generation merit attention. They are ingenious; but the reader muſt judge of their ſolidity. He alleges that all animals and vegetables are compoſed of an infinite aſſemblage of germs or organic living particles, which require only to be placed in certain circumſtances in order to produce an animal or vegetable of the ſame ſpecies. Theſe germs, or organic living corpuſcles, are all of a ſimilar figure and nature. In the ſame manner, ſalts, and ſome other mineral ſubſtances, are compoſed. A grain of ſea-ſalt is a cube conſiſting of an infinite number of ſmaller cubes, and theſe ſtill more minute, till, perhaps, we arrive at the primitive or conſtituent elements, which no glaſſes, nor any other human invention, can ever bring within the reach of our ſenſes. In the univerſe, our author remarks, the number of theſe living organized corpuſcles is infinite. Their conſtitutional ſubſtance is preciſely the ſame with that of thoſe organized bodies we ſee in Nature. For example, there is a vaſt profuſion of organic corpuſcles ſimilar to the animals with which we are acquainted. A combination of theſe forms an animal, in the ſame manner as a combination of ſmall cubes forms a grain of ſalt, or the combination of a number of vegetable corpuſcles produce a tree or a plant. But it is neceſſary to break down, or diſſolve, a grain of ſalt before we can diſcover the corpuſcles of which it is compoſed. The parts of a plant, or of an animal, muſt, in the ſame manner, be ſeparated, in order to diſcover, by means of vegetation or developement, the ſmall particles which enter into their compoſition. Every animal and vegetable ſubſtance is only a congeries of ſmaller animals and vegetables, though we are unable to make the diviſion. Hence, our author remarks, there exiſts in Nature multitudes of minute organized bodies ſimilar to the large organic beings which are exhibited in the world. Theſe ſmall beings, again, are compoſed of organic particles, which are common to animal and vegetable ſubſtances, give riſe to every part of organic matter, and are primitive and indiſtructible. An aſſemblage of theſe particles forms an organized body. Hence generation, or reproduction, is only a change of form occaſioned by the accumulation of ſimilar particles; and death, or diſſolution, is only a diviſion of this compound into its original and conſtituent parts.

In this manner, continues our author, ſeeds produce young trees, which formerly exiſted in miniature in their own ſubſtance. During the firſt year, at the top of the ſtems or trunks of trees, a ſmall bud appears, which contains a ſtem to be unfolded in the ſecond year. The ſame proceſs goes on annually with regard to the branches and leaves. Hence, he concludes, that the whole plant is an aſſemblage of ſimilar organic bodies. The more perfect and the more complex animals are, their reproduction is the more difficult, and their progeny the leſs numerous. During the growth of the body, all the organic particles extracted from food are totally abſorbed, and applied to augment the parts. For this reaſon, children are incapable of multiplying their ſpecies. But, when growth is nearly completed, the ſuperfluous molecules, or organic particles, are tranſmitted from all parts of the body to the teſticles and ſeminal veſſels, the reſervoirs appointed for them by Nature. At this period, the ſymptoms of puberty firſt begin to appear. Theſe particles, our author remarks, do not unite in the teſtes to form embryos. To accompliſh this effect, a mixture of thoſe belonging both to the male and female is indiſpenſable for the purpoſes of generation. When there are more male than female organic particles, the reſult is a male, and *vice verſa*. What determines theſe organic particles to come from all parts of the body, and to rendezvous in the teſtes? M. de Buffon anſwers, becauſe the organic particles are no longer able to penetrate the parts themſelves; they are rejected, and, of courſe, unite together by the ſame active force which formerly gave them the power of penetrating the different members of the body when in a more flaccid and ductile ſtate. In the courſe of circulation, every part attracts the particles which are moſt analogous to itſelf. After growth is completed, all the parts become more denſe; and, though the blood, as uſual, makes them an offer of organic particles, they are incapable of receiving them. The organic particles, therefore, being rejected by theſe parts of the body which formerly abſorbed them with avidity, are obliged to aſſemble in the teſtes, which are reſervoirs prepared by Nature for their reception.

Buffon made a great variety of experiments on the ſemen of different animals, which he diligently examined with the microſcope. The moving bodies in the ſemen, which Leuwenhoek, and indeed every man who choſe to view them, concluded to be animalcules, Buffon, in order, it ſhould appear, to deſtroy the homuncular ſyſtem, and to eſtabliſh a new one of his own, denies to be *animals.* He gives them, however, the appellation of *corps organiques vivans*, or *living organic bodies.* This may be a *diſtinction;* but we ſhall leave the reader to find out the *difference.* From theſe experiments our ingenious author reaſons in the following manner.

All animals, he remarks, are nouriſhed either by vegetable ſubſtances, or by other animals who feed upon vegetables. Hence there exiſts in Nature a matter common to both, which ſerves for the growth and nouriſhment of every thing that lives or vegetates. This matter effectuates growth and nouriſhment by aſſimilating itſelf to every part of the animal or vegetable, and by intimately penetrating the texture and *form* of theſe parts, which, ſays he, I have diſtinguiſhed by the appellation of an *internal mould.* When the quantity of this nutritive matter is more than ſufficient for the growth and expanſion of the animal or vegetable, it is detached from all parts of the body, and depoſited in one or ſeveral reſervoirs, under the form of a fluid. This fluid contains all thoſe particles which are analogous to the various parts of the body, and, of courſe, every thing neceſſary for the production, in miniature, of a being perfectly ſimilar to the firſt. This ſuperfluity of nutritive matter does not take place, in moſt animals, till they have nearly acquired their full growth; for this reaſon, animals are not capable of multiplying their ſpecies before this period. When this nutritive and prolific matter, which is diffuſed through all nature, paſſes through the internal mould of an animal or vegetable, and finds a proper matrix or receptacle, it gives riſe to an animal or vegetable of the ſame ſpecies. But, continues our author, when this prolific matter does not find a proper matrix, it produces organized beings totally different from *animals* or *vegetables*, as the *moving* and *vegetating* bodies which appear in the ſeminal fluids of animals, and in the infuſions of vegetable ſubſtances *. If this reaſoning is not *abſurd*, I know not the meaning of the *word*. This prolific matter is compoſed of organic particles, which are always active. Their motions are ſtopped or arreſted by the brute parts of matter in general, and particularly by ſaline and oily ſubſtances; but, whenever they are diſengaged from theſe ſubſtances, they reſume their activity and produce different ſpecies of animals and vegetables. The ſpermatic animals may be ſeen, by the aſſiſtance of the microſcope, in the ſeminal fluids of both male and female animals. The ſemen of viviparous females is filtrated through the glandular bodies which grow upon their teſticles; and theſe glandular bodies contain, in their cavities, a conſiderable quantity of ſeminal fluid. Oviparous females have a ſeminal fluid which is ſtill more active than that of the viviparous. The ſemen of the female is ſimilar to that of the male. They decompoſe in the ſame manner; they contain ſimilar organic particles; and they exhibit the ſame appearances.

Of this organic and prolific matter, all animal and vegetable ſubſtances contain a great quantity. To diſcover its exiſtence, we have only to ſeparate it from the brute matter in which it is entangled, by infuſing animal or vegetable ſubſtances in water: The ſalts diſſolve; the oils ſeparate; and the organic particles are perceived by their movements. They are more numerous and active in the ſemen, than in any other animal fluids. After fleſh has been infuſed for a ſhort time in water, the organic matter appears under the form of moving bodies, which are nearly as large as thoſe in the ſeminal fluid. But, after the infuſion has been longer continued, the ſize of the organic particles is diminiſhed, and their motion is augmented; and, when the fleſh is entirely decompoſed or corrupted, the organic particles are extremely minute, and their motions are inconceivably rapid. When large quantities of this organic and prolific matter are collected in any part of an animal body where the matter is forced to remain, it there forms *living beings*, which we have always regarded as *real animals!* The taenia, the aſcarides, all the worms found in the veins, in the liver, in wounds, in pus, and moſt of thoſe which are formed in putrified fleſh, have no other origin. The eels in paſte, in vinegar, and all the pretended, our author obſerves, microſcopic animals, are only different forms aſſumed, according to circumſtances, by this active matter, which has a perpetual tendency to organization.

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* Tranſ. of Buff. Vol. II. p. 347.

In infuſions of all animal and vegetable ſubſtances, this prolific matter firſt appears under the form of a kind of vegetation. We ſee it ſhoot into filaments, which grow and expand like plants. Their extremities and joints afterwards ſwell and burſt, to give paſſage to a multitude of moving bodies, which have ſome reſemblance to animals. Nature, it ſhould appear, commences all her operations by a kind of vegetable motion: This motion we perceive in a variety of microſcopic objects, and in the expanſion of the animal embryo; for, at firſt, a fœtus poſſeſſes only a ſpecies of vegetable growth or motion. Sound food furniſhes none of theſe moving particles: Freſh meat, grain, fruits, &c. require to be infuſed ſome days before they exhibit any of theſe moving bodies. The more any ſubſtance is corrupted, decompoſed, or exalted, as pus, blighted grain, ſeminal fluids, &c. the moving bodies the ſooner make their appearance. In ſeminal fluids, they are entirely diſengaged from other matter; and a few hours infuſion only is neceſſary to diſcover them in pus, corrupted grain, ſtrong drugs, &c.

From theſe and ſimilar facts, our author infers the exiſtence of an organic animated matter, univerſally diffuſed through all animal and vegetable ſubſtances, and which equally ſerves for their nouriſhment, their growth, and their reproduction. Nutrition, he ſays, is effected by the intimate penetration of this matter through every part of animal and vegetable bodies; expanſion, or growth, is only a more extenſive ſpecies of nutrition, which proceeds as long as the parts are ductile, and capable of being ſtretched; and reproduction is an effect of the ſame matter, when it ſuperabounds in the body of an animal or vegetable. Every part of organized bodies ſends off to proper reſervoirs all the organic particles which are ſuperfluous for its nouriſhment. Theſe particles are perfectly ſimilar to the different parts from which they proceed, becauſe they were deſtined for the nouriſhment of thoſe parts. When the whole particles ſent off from every part of the body are aſſembled, they muſt neceſſarily form a ſmall body ſimilar to the original, becauſe every particle is ſimilar to the part from which it was detached. In this manner, every ſpecies of reproduction, where one individual only is requiſite, as that of trees, plants, polypi, vine-fretters, &c. is effected. This is alſo the firſt method employed by Nature for the reproduction

tion of ſuch animals as require the aid of different ſexes; for the ſeminal fluid of each ſex contains all the particles neceſſary for reproduction: But, among the larger animals, the mixture of both fluids, in a place ſuited to the expanſion and growth of the fœtus, is requiſite; and this place is the uterus of the female.

After reaſoning in this manner, from the facts enumerated by him, M. de Buffon draws the following concluſions: There are, therefore, ſays he, no pre-exiſting germs, or germs contained infinitely within each other. But there is an organic matter diffuſed through all animated nature, which is always active, and has a perpetual tendency to form, to aſſimilate, and to produce beings ſimilar to thoſe into which it enters. Hence the ſpecies of animals and of vegetables can never be exhauſted: As long as individuals ſubſiſt, the different ſpecies will be conſtantly kept up; they are the ſame now that they were three thouſand years ago. By their own powers they will perpetually exiſt, unleſs they be annihilated by the will of their Great CREATOR.

§ 10.—We ſhall now proceed to the theory of the ingenious C. BONNET. In his *Conſiderations ſur les Corps Organiſes*, Bonnet ſuppoſes that germs, or buds, exiſt in the uterus of the female, and contain the matter or rudiments of the fœtus; and that the impregnation of the male has no other effect than that of putting theſe germs in a condition proper for their evolution and growth. The animalcular ſyſtem, our author remarks, makes the germs, or rudiments of animals, reſide in the ſpermatic animalcules, and the uterus affords only a convenient nidus for beſtowing the warmth and nouriſhment neceſſary for the evolution of the parts. The exiſtence of theſe animalcules in females ſeems to deſtroy this hypotheſis, unleſs it ſhould be ſuppoſed that they copulate and produce a third being, which becomes the rudiments of a fœtus, or that they unite in numbers to compoſe a large homogeneous maſs. The farina of plants, and the ſemen of animals, are the nutritive particles deſtined by Nature for the growth and evolution of the original germs. Bonnet ſuppoſes that the germs, whether male, female, or neuter, as in bees, exiſt previouſly in the ovaria of the mother, and that the male ſemen only cheriſhes and unfolds what formly exiſted.

Bonnet endeavours to obviate ſome difficulties to which his theory gives riſe. For example, why ſhould mules reſemble both ſpecies from which they proceed? Theſe reſemblances, he obſerves, are ſeldom uniform, or take place in the ſame parts. It has, however, been remarked, that, in general, the body of a mule reſembles the female more than the male; but that the extremities have a greater reſemblance to thoſe of the male. On this branch of the ſubject, he confines himſelf chiefly to reſemblances in colour, which, he thinks, are eaſily accounted for by regarding the ſemen as a nutritious fluid. We know, ſays he, that the quality of the aliment has a great influence on the colour of organized bodies. By feeding on madder, the bones of fowls, and of other animals, are ſoon changed into a red colour. We can vary the ſhades of plants by making them abſorb different fluids of different colours.

But, he proceeds, it may be ſaid, that the colours impreſſed on the germ by the ſeminal fluid ſhould alter gradually, and at laſt vaniſh entirely. To remove this difficulty, our author replies, that the reflection of particular colours depends on the nature and texture of the parts; when theſe are determined, it is very probable that the colours remain, and that the nutritious particles conveyed to theſe parts receive the ſame tinges. A germ he defines to be the rudiment or ſketch of an organized body. This idea, he confeſſes, is not ſufficiently clear. But, he remarks, that we muſt either attempt a mechanical explanation of the mode in which organs are formed, which exceeds all human powers, or we muſt admit that the germ actually contains in miniature all the parts eſſential to the animal. The principal difference, then, between a germ and a real animal is, that the germ is compoſed ſolely of elementary particles, and that the texture formed by theſe particles is extremely condenſed; but that, in the animal, the elementary particles, by means of nutrition, are aſſociated with an infinity of other particles. The variety which takes place in all parts of animals, whether with regard to their proportions or conſiſtence, ſhows that the ſame variety exiſts in the elements from which they originated. The degree of extenſion in the different parts is proportioned to the power by which they were produced. This power, in the preſent ſubject, is the ſeminal or nouriſhing fluid.

To theſe general reflections, our author proceeds, I ſhall add ſome particular conjectures. 1. I ſuppoſe, ſays he, that, in the ſeminal fluid, the ſame ſpecies of elements exiſt as enter into the compoſition of the germ. 2. That elements of the ſame kind have a greater diſpoſition to union, than thoſe of a different nature. 3. That the texture, or tiſſue, of each part bears a certain proportion to the relative particles of the ſemen. 4. That the efficacy of the ſeminal liquor depends on the degree of its heat and motion, and on the number of the different kinds of elementary particles it contains. Upon theſe ſuppoſed principles, he remarks, the generation of mules by the junction of the aſs and mare may, in a certain degree,

gree, be explained. This production, ſays he, formerly exiſted in the ovaria of the mare under the form of a horſe. But how ſhould this horſe undergo ſuch a change? From whence proceed theſe long ears? Why is the tail furniſhed ſo ſcantily with hair? To theſe queſtions, he replies, that, though the elements of the ſeminal fluid of the aſs correſpond, in general, with thoſe of the germ, it contains a proportionally greater number of particles ſuited to unfold the ears. On the other hand, it has fewer particles neceſſary for expanding the tail.

SECT. III.

Of Singularities in the Mode of Multiplying among certain Animals.

IN the firſt volume of this work, I have enumerated ſo many examples of the multiplication of animals, without the intervention of two ſexes, which, though ſtrictly connected with this ſubject, it is unneceſſary to repeat; and, therefore, muſt refer the reader to a peruſal of that part of the book where thoſe examples are to be found [*].

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[*] Phil. of Nat. Hiſt. Vol. I. p. 30. &c.

SECT. IV.

Of Partial Reproduction—Some Animals, from peculiarities in their conſtitutions, have the power of reproducing parts of their bodies which have been lopped off—Suppoſed cauſes of this ſurpriſing faculty.

IN the more perfect animals, as man, quadrupeds, birds, &c. whoſe multiplication is regulated by general and ſimilar laws, if any member or part of their bodies is deſtroyed, it is impoſſible, it ſhould appear, for either art, or Nature herſelf, to repair the loſs. But, in ſome inferior animals, whoſe texture is more ductile, though deprived, by force or by accident, of particular members of their bodies, their conſtitutions have the power of reproducing the loſt parts, and of reſtoring them to their originally perfect ſtate; and, in ſome inſtances, when the body of an animal is divided, it gives riſe to as many individuals as there are diviſions, as in the polypus, &c.

The earth-worm, when cut into two or more portions, does not die. On the contrary, when the different portions are placed in proper circumſtances, each of them gradually becomes a perfect animal. BONNET informs us, that he cut a worm of this kind into two equal parts on the 27th day of July; and that, on the 15th of Auguſt, he perceived, at the poſterior part of the inſect to which the head was attached, a ſlender vermicular appendage, about eight or nine lines in length. Its colour was brighter than the reſt of the body. It had the appearance of a ſmall worm proceeding from the extremity of the larger. This appendage, or rather this new poſterior part, was highly organized. It was compoſed of a ſucceſſion of very cloſe rings, upon the ſides of which the *ſtigmata*, or apertures deſtined for the purpoſes of reſpiration, were perceptible. What was ſtill more curious, the great artery, or that veſſel which, in inſects, performs the functions of the heart, was apparent. In this artery, from the one extremity of it to the other, the alternate motions, called *ſyſtole* and *diaſtole*, were perfectly evident. The circulation of the blood in this new production, in the ſame manner as in the reſt of the body, proceeded from the poſterior to the anterior extremity. In earth-worms, the blood is of a fine red colour, which gave M. BONNET an opportunity of diſtinguiſhing eaſily its motion and direction. At the end of a month and a half, from the operation, this new poſterior part, which at firſt was ſo ſlender, had acquired a thickneſs almoſt equal to that of the reſt of the body, and it had grown proportionally in length. Its colour was deeper, and the new inteſtines were full of earth, which is the food of that ſpecies of inſects. After what I have related, ſays BONNET, it muſt be acknowledged, that the earth-worm has the faculty of reproducing parts of its body after they have been cut off. The poſterior part, though lively and active at the end of nine months, ſhowed no ſymptoms of reproduction. After ſo long an abſtinence, it at laſt periſhed for want of food.

With a view to obſerve more particularly the reproduction of the anterior part, BONNET cut from an earth-worm the head and ſeveral rings. This experiment was begun about the end of July. Toward the middle of Auguſt, the wound was perfectly cicatriſed ; but no marks of reproduction appeared. The wound was circumſcribed by a pretty elevated border formed by the old fleſh, and made a kind of hollow in the middle reſembling a ſmall baſon. In a few days more, he obſerved, in the centre of this depreſſion, a white point, which, by gradually increaſing, aſſumed the form of a ſmall bud. On the twentieth day of September, this bud was lengthened, and terminated in a ſoft point. On the ſecond day of October, it was ſtill longer, and had aſſumed the appearance of a ſmall worm, which iſſued from the middle of the cicatrice. In the months of November and December, the new part continued to lengthen, and to grow proportionally thick. The death of the inſect put an end to farther obſervations. BONNET remarked ſimilar appearances in earth-worms which had been divided into three, four, and five portions. From the intermediate portions, both an anterior and poſterior part began to ſhoot at the ſame time. But the progreſs of the former, in equal times, was much greater than that of the latter. When the poſterior part had acquired three lines in length, the anterior part appeared only under the form of a ſmall bud ; and, when the anterior part was between two and three lines long, the poſterior was at leaſt ſix lines, or half an inch. All theſe ſections of worms, however, died without reproducing a complete anterior part.

BONNET made ſimilar experiments on certain ſpecies of worms which live in freſh waters. They afford an example of a much more rapid reproduction than can be obtained from the earth-worm. Sections of theſe worms, in a few days, become complete animals. The anterior part ceaſes to grow as ſoon as it has acquired the length of a line, or a line and a half. The poſterior part, on the contrary, ſometimes ſtretches out to the length of ſeveral inches. Portions, even cut from the middle of the body, reproduce a new head and a new tail. Another ſpecies of freſh-water worm is of a whitiſh or aſh colour. It is remarkable, that, when **BONNET** cut tranſverſely the body of this worm into two or ſeveral portions, each portion, at its anterior extremity, reproduced a tail inſtead of a head. This tail, as might be ſuſpected, was not a head more than commonly ſlender. It was a well-formed tail, in which the anus was diſtinctly viſible. This reproduced part, the worm did not uſe either for the purpoſes of moving or of taking food. It only made vibrations occaſionally from right to left, but without the ſmalleſt attempt to progreſſive motion. It is remarkable, that in this tail, inſtead of a head, the circulation of the blood did not change its direction, but continued, as uſual, to move from the poſterior to the anterior part of the body. It is ſtill more remarkable, that the ſections of theſe worms, which reproduce a tail inſtead of a head, never receive any nouriſhment. Their ſtomach and inteſtines, though the anomalous creatures ſometimes lived ſeven months, were always tranſparent, and never contained any food.

But theſe inſtances of reproduction are confined to very ſmall animals. I now give an example of regeneration of parts lopped off in an animal prodigiouſly large, when compared with the polypus, or the freſh-water worms, formerly deſcribed.

Long before the hiſtory of the polypus was known, philoſophers admired the reproduction of the claws of the cray-fiſh, a ſpecies of lobſter. But no perſon has traced the progreſs and circumſtances attending this reproduction with equal exactneſs and ſagacity as the celebrated M. DE REAUMUR *.

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* Mem. de l'Acad. Royale des Sciences, anno 1712.

The claws of the cray-fiſh, reckoning from the end of the pincher, conſiſt of five articulations, at the fourth of which the claw breaks moſt frequently, and here it is alſo moſt eaſily reproduced. When the claw, whether by accident or deſign, has been broken at or near this articulation, the part which remains attached to the body exhibits a round ſhelly opening or tube. This tube is occupied entirely with a fleſhy ſubſtance. In a day or two, eſpecially if the experiment is made in ſummer, a red membrane, like a piece of cloth, ſhuts up the aperture. This membrane is at firſt plain; but, in four or five days, it aſſumes a convexity, which gradually augments, till it takes the appearance of a ſmall cone, which exceeds not a line in heighth. It continues, however, to ſtretch out; and, in ten days, it is ſometimes more than three lines, or about a quarter of an inch, high. It is not hollow, but filled with fleſh, and this fleſh is the baſis or rudiments of a new claw. The membrane which covers the fleſh performs the ſame office to the young claw as the membranes do to the foetus of the larger animals. It extends in proportion as the animal grows; and, as it is pretty thick, we can perceive nothing but a lengthened cone. When fifteen days are elapſed, this cone inclines toward the head of the animal. In a few days more, its curvature increaſes, and it begins to aſſume the appearance of a dead claw. This claw, though, at the end of a month or five weeks, it has acquired the length of ſix or ſeven lines, which is more than half an inch, is ſtill incapable of action. The membrane in which it is incloſed becoming gradually thinner in proportion as it extends, gives an opportunity of obſerving the parts of the claw, and we now perceive that this conical ſubſtance is not a ſimple congeries of fleſh. The moment is now arrived when the claw begins to be brought forth. The membrane at laſt burſts, and the new claw, though ſtill ſoft, appears without incumbrance or inveſtment. In a few days more, it is covered with a ſhell, and, though ſtill delicate, and not the half of its former length, it performed all its natural functions. It has likewiſe been diſcovered, that, whether the claw has been lopped off at the fourth articulation, or any where elſe, the animal, in a ſhort time, recovers all that it had loſt. The ſame reproduction takes place in the claws and in the horns ; but, what is ſingular, if the tail is cut off, the animal ſurvives a few days only.

To account for theſe and ſimilar reproductions, **BONNET** has recourſe to his favourite hypotheſis of pre-exiſting germs. When the claws of the cray-fiſh, or the parts of certain inſects, are cut off from their bodies, he ſays, that the germs or buds of theſe parts ſtill remain, and require nothing but time and proper circumſtances to unfold and to reſtore the parts which had been loſt.

BONNET's theory is ingenious, and his knowledge of Nature is extenſive. Still, however, I am afraid, that, notwithſtanding his great talents and induſtry, he has related the facts only, without being able to aſcertain, or to explain in a ſatisfactory manner, the cauſes by which they are produced. An infinite ſeries of germs, all capable of either giving riſe to entire animals, or of reſtoring the loſt parts of animals, ſeems to be an incomprehenſible idea, and adds nothing to our knowledge of the operations of Nature. How ſhe acts, in theſe and ſimilar circumſtances, we never, it ſhould appear, can either diſcover or comprehend.

SECT. V.

General Reflections and Obſervations.—Suppoſed Effects of the Imagination upon pregnant Animals.

I HAVE now given an hiſtorical account of this moſt intricate ſubject, which has occupied the attention of great and learned men both in antient times and in our own. Before concluding, I muſt, however, be indulged with a few remarks.

The mode employed by Nature for multiplying animals, by the commixture of ſexes, though inveſtigated with anxiety by ingenious men for many ages, is ſtill, and muſt for ever remain a myſtery. I ſhall not diſturb my readers with particular remarks upon the various theories of which I have given abridged, but, I hope, ſatisfactory views. Much muſt be left to their own reflection. It may, however, be obſerved, upon the whole, that great labour and great ingenuity have been exerted in order to elucidate a ſubject ſo intereſting, and ſo calculated to excite the curioſity of beings endowed with any conſiderable portion of rational powers.

The moſt plauſible theories are thoſe of HARVEY, LEUWENHOEK, and BUFFON.

Harvey's idea of eggs is ingenious, and founded on a ſtrong analogy. But the facts he produces ſeem not ſufficient to ſupport the hypotheſis he has adopted. If we reflect on oviparous animals, from the humming-bird to the largeſt of the feathered tribes, we ſhall perceive that the eggs bear ſome proportion to the magnitude of the animal which gives birth to them. But in man and the larger quadrupeds, what **Harvey**, and many other writers of reputation, have choſen to denominate *eggs* in their ovaria, are almoſt infinitely diſproportioned, by their minuteneſs, to the magnitude of the animals which are ſuppoſed to proceed from them. An elephant, or even a human being, produced from an *egg* not ſo large as a *pea*, requires a degree of faith that few men poſſeſs. Here the analogy between real oviparous animals and the larger quadrupeds ſeems too diſtant. and even too ridiculous, to obtain general credit. Beſides, how is this egg, after impregnation, to enter the Fallopian tube, and be, through this channel, conveyed into the uterus ? The Fallopian tubes have no immediate connection with the ovaria. But we are told, that, in the moment of impregnation, the *fimbriae*, or fringed mouths, of the Fallopian tubes, embrace the ovaria, ſwallow an egg, and tranſmit it to the uterus, where it is cheriſhed, hatches, and, in proper time, produces a living animal ! Whoever is capable, after conſidering the ſtructure of the parts, of believing this ſtrange proceſs, ſeems to have more faith than is neceſſary to conſtitute a good Muſſelman.

Leuwenhoek's vermicular theory is ſtill more complicated, and leſs intelligible. That animalcules, or moving bodies, really appear, by the aſſiſtance of the microſcope, in the ſemen of animals, is an inconteſtible fact. But our author conſiders theſe moving bodies as real animals, according to the ſpecies, which require only a proper *nidus* for their growth and perfection of their parts. **Leuwenhoek** ſuppoſes that, when one of theſe animalcules gets admittance to the uterus, its parts, which formerly exiſted, are gradually unfolded till at laſt it becomes an animal completely fitted to ſee the light, and to perform the various functions of life. He tells us, that, in the ſemen of ſome ſpecies, millions of animalcules are not equal in bulk to a grain of ſand, and that, in others, many millions of them would not make the thickneſs of a hair. In the ſeeds of plants, Nature, for many obvious reaſons, is very profuſe. But, in the animal kingdom, no ſuch reaſons exiſt. In one impregnation, according to **Leuwenhoek**'s hypotheſis, millions of animated beings periſh, when one only has the good fortune to ſurvive. What are the devaſtations of all the hoſtile armies ſince the creation of the world, when compared to this immenſe waſte of animals, even in the life of a ſingle man, or rather in the impregnation of a ſingle female?

The idea of animalcules exiſting in the ſemen of males, and of afterwards becoming perfect animals, does not in the ſmalleſt degree advance our knowledge of the multiplication of ſpecies. The queſtion ſtill recurs. What gives riſe to theſe animalcules? How are they produced? Do they conſiſt of males and females? Suppoſing they did, they would only multiply their own number, from which nothing farther, in the ordinary courſe of nature, could poſſibly proceed. With regard to this vermicular hypotheſis, it ſhall only be remarked, that if the ſpermatic worms of men were the rudiments of real human beings, which required only a proper ſituation for having their parts expanded, why ſhould myriads of them be deſtroyed, and only a favoured one be ſelected, and at laſt brought to perfection? Animation, particularly in the human ſpecies, implies a ſoul, or a thinking principle. What, it may be aſked, becomes of thoſe millions of ſouls which are daily, to us at leaſt, loſt? Are they annihilated? If ſo, why create ſuch ſuperfluous multitudes for no other ſeeming purpoſe but to hurry them prematurely out of exiſtence? The reader, I imagine, is now completely tired of this ridiculous *worm-theory* of generation, I ſhall, therefore, make a few remarks upon that of my late learned, reſpected, and moſt ingenious friend and correſpondent, the COUNT DE BUFFON.

This illuſtrious author, fully perſuaded that the notion of thoſe moving atoms, diſcernible in the ſemen, being real animals was abſurd, adopts an hypotheſis, which, though apparently different, amounts nearly to the ſame thing. To what LEUWENHOEK and others call *animalcules*, BUFFON, by a circumlocution, gives the denomination of *corps organiques vivantes*. Theſe moving particles, he ſays, have a conſtant tendency to unite, and to form larger animated bodies of a ſimilar nature. The only difference between LEUWENHOEK's *worms*, and BUFFON's *living organic particles*, ſeems to be this: The former makes a ſingle *worm*, or *homunculus*, ſufficient to produce a perfect animal. The latter takes a wider range, and ſuppoſes a numerous congeries of them neceſſary to accompliſh the ſame end. The idea, that a number of *living* organic bodies ſhould unite, and form only *one living* organized body, ſeems to be very remote from any known analogy; and no man will pretend to demonſtrate the ſuppoſed fact.

Whoever peruſes theſe ſketches of the various theories of the generation of animals which have hitherto been invented, will probably require no other arguments to convince him that philoſophers and phyſicians are ſtill as ignorant of this myſterious proceſs of Nature as they were in the days of HOMER.

Suppoſed Effects of the Imagination upon pregnant Animals.

THIS branch of the ſubject, to ſome readers, may ſeem too contemptible and too ridiculous to be treated of in a ſerious manner. But it is the duty of philoſophers to remove prejudices, and eſpecially ſuch as are really hurtful to mankind. In this country, at leaſt, there is not a deeper rooted prejudice than that ſtrawberries, fruit of any kind, a mouſe, &c. when thrown at a pregnant woman, produce, by means of her imagination, or apprehenſion, marks ſimilar to theſe objects in the part of the foetus correſponding to that on which the mother was ſtruck. Theſe marks are even ſuppoſed to be transferable from one part of the body to another. For example, when any thing is thrown at a pregnant woman, either by accident or deſign, if ſhe inſtantly puts her hand on her hip, this action, it is firmly believed, transfers the mark to that part of the child's body, and prevents the more expoſed parts, as the face and hands, from being deformed.

But the ſuppoſed effects of imagination upon the foetus are not confined to ſubſtances thrown at the mother. Fear, love, or any ſtrong deſire, are ſaid to produce derangements in the foetus. For this reaſon, pregnant women are carefully prevented from ſeeing negroes, apes, or any other animal that may create terror or ſurprize. We are told that a woman in Paris, who happened to be with child when ſhe ſaw a criminal broken upon the wheel, was ſo ſtruck with the dreadful ſpectacle, that the bones of the infant ſhe afterwards produced were preciſely in the ſame condition with thoſe of the unfortunate ſufferer. Similar effects are apprehended when a woman, in this condition, has a ſtrong deſire to eat particular fruits, or is affected with any other appetite which, at the time, cannot be gratified.

That pregnant women, agitated by any violent paſſion, placed in dangerous ſituations, or frightened by ſome ferocious animal, ſhould occaſionally produce deformed or even maimed children, is by no means impoſſible. Between the mother and the fœtus the connection is ſo intimate, that a violent agitation in the ſpirits and blood of the former may be communicated to the latter, and give riſe to diſorders which the parts of the mother are able to repel, but to which the more delicate texture of the fœtus muſt yield. We daily perceive involuntary motions extended to much greater diſtances than from the mother to the child in her womb. When a man walking before us makes a falſe ſtep, we aſſume naturally that poſition of our bodies which he ſhould take, in order to prevent himſelf from falling. We cannot ſee other men ſuffer, without feeling a part of their pain. This is the bond by which Nature attaches mankind to each other. Pleaſure and pain are the two maſters of this world. Without the one, few animals would take the trouble of continuing the ſpecies: If we had no dread of the other, many men would not chuſe to protract their exiſtence.

But the effects of terror muſt not be confounded with thoſe commonly ſuppoſed to be produced by a ſlight and momentary imagination of the mother. Terror may occaſion great derangements in the ſoft texture of a fœtus; but theſe derangements have no reſemblance to the objects by which they are produced. It is much more probable, that the terror occaſioned by a tiger, or other rapacious animal, ſhould produce the death of the child, or great derangements in its parts, than that the ſame terror ſhould give riſe to ſpots and claws reſembling thoſe of the tiger. Beſides, an infant brought forth with its bones broken as if upon the wheel, would not be ſo ſurpriſing, as the mark of a cherry proceeding from no other ſource than becauſe the mother wiſhed to eat a cherry. Nothing, however, is more common than marks which are ſuppoſed to derive their origin from the longings of the mother. A mark of this kind is ſometimes called a *cherry*, ſometimes a *raiſin*, and ſometimes a *fiſh*! After examining a number of theſe marks, M. MAUPERTUIS acknowledges, that he never ſaw one which could not eaſily be reduced to ſome excreſcence, or to ſome accidental blotch on the ſkin *. The relation of mothers, that they remembered, during their pregnancy, to have had certain fears or deſires, merits but little attention; for they never recollect to have had theſe fears or deſires till they have brought forth a child with ſome uncommon mark on its body. Their memory then ſupplies them with whatever they want. If the mark has ſome fancied reſemblance to a fruit or to an animal, they inſtantly recollect, that they longed for the one, or were frightened by the other. It is not indeed wonderful, or rather it is highly probable, that, in the courſe of nine months, any woman, whether pregnant or not, ſhould be afraid of ſome animal, or have a deſire to eat a particular kind of fruit.

In theſe ſuppoſed effects of imagination, it may be aſked, Why are not the impreſſions, and often cruel ones, of the whip, ſeen upon the offspring of mares, and ſhe-aſſes? It may, perhaps, be alleged that the inferior animals have no imagination. No perſon however, who obſerves the œconomy of the moſt common quadrupeds can entertain a doubt that they are poſſeſſed of this power; but they have not the folly to exerciſe it in a manner ſo abſurd. A mare, a ſhe-aſs, or a cow, though hunger often obliges them to long violently for particular kinds of food; yet their offspring never exhibit marks of graſs, of hay, of cabbages, or of turnips.

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* Oeuvres de Maupertuis, Tom. II. p. 78. 79. Art. Venus Phyſique.

I ſhall conclude this ſubject with a few obſervations, the principal intention of which is to remove the prejudices juſt mentioned, and, of courſe, to prevent, if poſſible, the apprehenſions of females ariſing from imaginary, but often hurtful, cauſes. Though the human fœtus is, in ſome meaſure, equally independent of the mother, as the egg is independent of the hen by which it is covered; yet, it is aſſerted that, whatever affects the mother produces a ſimilar effect upon the fœtus, and that the impreſſions received by the one are communicated to the other. To this imaginary influence all thoſe reſemblances, and marks, which appear on the ſkin of particular children, have been attributed. 'Many of theſe marks,' ſays the COUNT DE BUFFON*, 'I have examined, and they uniformly appeared to be occaſioned only by a derangement in the texture of 'the ſkin. Every mark muſt neceſſarily have a faint reſemblance to 'ſomething or other: But ſuch reſemblances, I am perſuaded, depend more on the imagination of thoſe who ſee them, than upon 'that of the mother. On this ſubject, the marvellous has been 'puſhed to an extreme degree. The fœtus has not only been ſaid 'to bear the real repreſentations of the appetites of the mother, but 'that, by a ſingular ſympathy, the marks which repreſent ſtrawberries, cherries, &c. aſſume a deeper colour during the ſeaſon of 'theſe fruits. A little attention, however, will convince us, that 'theſe changes of colour are more frequent, and that they happen 'whenever the motion of the blood is accelerated, whether it be 'occaſioned by the heat of ſummer, or by any other cauſe. The

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* Tranſlat. Vol. II. p. 330.

'marks are always either yellow, or red, or black; becauſe the 'blood gives theſe colours to the ſkin when it enters in too great 'quantities into the veſſels. If theſe marks were occaſioned by the 'appetites of the mother, why are not their forms and colours as 'various as the objects of her deſires? What a multitude of ſtrange 'figures would be exhibited, if all the whimſical longings of a mother were written on the ſkin of the child? As our ſenſations 'have no reſemblance to the objects which excite them, it is impoſſible that deſire, fear, horror, or any other paſſion or emotion, 'can produce real repreſentations of the objects by which they are 'occaſioned. An infant being, in this reſpect, equally independent 'of the mother as the egg is independent of the hen that ſits upon 'it, I ſhould be equally induced to believe, that the imagination of 'a hen, which ſaw by accident a cock's neck twiſted, ſhould produce wry-necked chickens from the eggs ſhe was hatching, as that 'a woman, who ſaw a man broke upon the wheel, ſhould produce, 'by the mere force of imagination, a child with all its limbs 'broken.'

Even if this laſt fact were well aſcertained, it could never be occaſioned by the imagination of the mother. What is the effect of horror? An internal movement, or perhaps a convulſion of the mother's body, which might alternately compreſs and dilate the uterus. What would be the conſequence of ſuch a commotion? Nothing, ſurely, ſimilar to its cauſe: For, if the commotion was very violent, the fœtus might have ſome of its parts deranged, or even its life might be extinguiſhed. But, is it poſſible to believe that this agitation ſhould produce in the fœtus any thing ſimilar to the thoughts or feelings of the mother? Among the infinite combinations of which Nature is capable of forming, that arrangements, both in animated and inanimated beings, of peculiar and extraordinary kinds ſhould ſometimes happen, is not an object of wonder. Of the numberleſs children, therefore, which daily come into the world, one may occaſionally appear with two heads, with four legs, or with the bones of all its members broken, or rather not fully united. The fœtus, as formerly remarked, poſſeſſes nothing in common with the mother. Its organs, its functions, its blood, are all peculiar to itſelf. The only matter it derives from the mother is the nutritive lymph which is ſecreted by the uterus. If this lymph is any how vitiated, if it be tainted with the venereal virus, the fœtus receives the infection; and it is reaſonable to think, that all diſeaſes proceeding from vitiated humours may be communicated from the mother to the child. The ſmall pox is often communicated in this manner; and we have too many examples of children, immediately after birth, becoming innocent victims of their parents debauchery.

We ſhould not have dwelt ſo long upon this ſubject, were it not for an earneſt deſire to remove a hurtful, and ſometimes a dangerous prejudice, to which women, even in the higheſt ranks of life, are unfortunately ſubjected. This prejudice, from whatever ſource it derived its origin, is very antient. In the 30th chapter of Geneſis, we find the following moſt curious paſſage, which is an interlocutory bargain between Laban and Jacob: 'And it came to paſs, when 'Rachael had born Joſeph, that Jacob ſaid unto Laban, ſend me 'away, that I may go into mine own place, and to my country. 'Give me my wives and my children, for whom I have ſerved thee, 'and let me go; for thou knoweſt the ſervice which I have done 'thee. And Laban ſaid unto him, I pray thee, if I have found 'favour in thine eyes, tarry; for I have learned, by experience, that 'the Lord hath bleſſed me for thy ſake. And he ſaid, Appoint me

‘ my wages, and I will give it. And he ſaid unto him, Thou knoweſt how I have ſerved thee, and how thy cattle was with me. For it was little which thou hadſt before I came, and it is now increaſed into a multitude; and the Lord hath bleſſed thee ſince my coming; and now, when ſhall I provide for mine own houſe alſo? And he ſaid, What ſhall I give thee? And Jacob ſaid, Thou ſhalt not give me any thing; if thou wilt do this thing for me, I will again keep and feed thy flock. I will paſs through all thy flock to-day, removing from thence all the ſpeckled and ſpotted cattle, and all the brown cattle among the ſheep, and all the brown and the ſpotted and ſpeckled among the goats, and of ſuch ſhall be my hire. So ſhall my righteouſneſs anſwer for me in time to come, when it ſhall come for my hire before thy face: Every one that is not ſpeckled and ſpotted amongſt the goats and brown amongſt the ſheep, that ſhalt be accounted ſtolen with me. And Laban ſaid, Behold, I would it might be according to thy word. And he removed that day the he-goats, that were ring-ſtraked and ſpotted, and all the ſhe-goats that were ſpeckled and ſpotted, and every one that had ſome white in it, and all the brown among the ſheep, and gave them into the hands of his ſons. And he ſet three days journey betwixt himſelf and Jacob: And Jacob fed the reſt of Laban’s flock. And Jacob took him rods of green poplar, and of the haſel and cheſnut tree; and pilled white ſtrakes in them; and made the white appear which was in the rods. And he ſet the rods which he had pilled before the flocks in the gutters in the watering troughs, when the flocks came to drink; that they ſhould conceive when they came to drink. And the flocks conceived before the rods, and brought forth cattle ring-ſtraked, ſpeckled, and ſpotted. And Jacob did ſeparate the lambs, and ſet the faces of the flocks toward the ring-ſtraked, and all the

‘ brown in the flock of Laban; and he put his own flocks by them-
‘ ſelves; and put them not unto Laban’s cattle. And it came to
‘ paſs whenſoever the ſtronger cattle did conceive, that Jacob laid
‘ the rods before the eyes of the cattle in the gutters, that they might
‘ conceive among the rods. But when the cattle were feeble, he
‘ put them not in; ſo the feebler were Laban’s, and the ſtronger
‘ Jacob’s.’

We ſhall make no obſervations on this remarkable paſſage, but, after what has been formerly ſaid on the ſubject, leave it entirely to the judgment of the reader.

CHAPTER III.

SECT. I.

Of Mules, or the anomalous productions of Nature—Mules ſprung from the horſe and aſs not entirely unprolific—Of the Jumar, an animal ſuppoſed to be produced between the bull and mare—Different ſpecies of ſmall birds unite, and their progeny retain the power of multiplication.

THE anomalous productions of Nature excite aſtoniſhment in the vulgar, and call forth the reaſonings of the ſpeculative. From the ſingularity of their appearances, and that love of oddity to which moſt men are addicted, it is natural to imagine, that this ſubject ſhould have long ago been exhauſted. But the concluſion, however plauſible, is by no means juſt; for the production and oeconomy of mules have never obtained a philoſophical diſcuſſion. Much has been written; many theories have been fabricated; but the number of experiments bear no proportion to the quantity of ſpeculation. The maxim, That mules cannot perpetuate their kind, is eſtabliſhed. But, like many other maxims, it has been rendered general, more from the indolence of mankind, than from their inquiry into the genuine operations of Nature.

The **Count de Buffon**, however, in a ſupplementary volume to his hiſtory of quadrupeds, has given a conſiderable degree of probability to the fertility of mules. He laments, that, in the production of them, few experiments have been made, and that even theſe have been confined to animals poſſeſſed of the weakeſt prolific powers. Some ſpecies have a natural antipathy to others. But, when managed with addreſs, theſe antipathies may be removed. **Buffon** endeavoured to procure a conjunction between the dog and the wolf: He failed in the attempt. But, in the year 1773, **Le Marquis de Spontin Beaufort** ſucceeded. From a ſhe-wolf and a maſtive dog, he obtained four puppies at one litter *. Theſe animals, who had been brought up in familiarity with each other, joined ſpontaneouſly. Inſtances are even recorded of mutual attachment between a dog and a ſow, though their attempts were abortive †. The exiſtence of the *jumar*, a production between a bull and a mare, or between a bull and a ſhe-aſs, though particularly deſcribed by **St Leger**, and ſome other writers, has not obtained general credit. But that a bull and a mare ſpontaneouſly joined, we have direct evidence from **Buffon** ‡. ‘ In the year 1767,’ ſays this ingenious author, ‘ and ſome ſucceeding years, the miller at my eſtate of ‘ Buffon kept a mare and a bull in the ſame ſtable, who contract‘ ed ſuch a paſſion for each other, that, as often as the mare came in ‘ ſeaſon, the bull covered her three or four times every day. Theſe ‘ embraces were repeated during ſeveral years, and gave the maſter ‘ of the animals great hopes of ſeeing their offspring: Nothing, how‘ ever, reſulted from them. All the inhabitants of the place were

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* Supplement a l'Hiſt. des Anim. Quadruped. par **Buffon**, p. 9. 10. & ſeq. and Tranſ. vol. 8. p. 19.

† Supplement, &c. par **Buffon**, p. 35. and Tranſ. vol. 8. p. 10.

‡ Tranſ. vol. 8. p. 37.

'witneſſes to this fact, which proves, that, in our climate at leaſt, 'the bull cannot procreate with the mare, and renders this kind of 'jumar extremely ſuſpicious. I have not equal evidence to oppoſe 'to the ſecond kind, which Dr SHAW ſays proceeds from the jack-'aſs and cow. I acknowledge, that, though the diſſimilarities in 'ſtructure appear to be nearly equal in both caſes, the poſitive teſti-'mony of a traveller ſo well informed as Dr SHAW, ſeems to give a 'greater degree of probability to the exiſtence of this ſecond kind of 'jumar than we have for the firſt. With regard to the third jumar, 'proceeding from the bull and ſhe-aſs, I am perſuaded, notwithſtand-'ing the authority of MEROLLE, that it has no more exiſtence than 'the one ſuppoſed to be produced by the bull and mare. The nature 'of the bull is ſtill farther removed from that of the ſhe-aſs, than 'from that of the mare: And the unfertility of the mare and bull, 'which is aſcertained by the above examples, ſhould apply with 'greater force to the union of the bull and aſs.'

Some of the antients mention the fecundity of common mules. ARISTOTLE tells us, that the mule coupled with the mare, and produced an animal called by the Greeks *hinnus* or *ginnus*; and that the female mule readily conceived, but ſeldom brought her offspring to perfection *. The ſame fact is mentioned by PLINY as recorded in the Roman Annals.

But BUFFON produces evidence of a leſs equivocal nature. M. DE BORY communicated to the COUNT DE BUFFON a certificate, atteſted by many credible witneſſes, that, in the month of May 1769, a female mule brought forth a well formed-foal in the iſland of

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* Ariſt. Hiſt Anim. lib. 6. c. 24.

St Domingo *. He adds, that, on account of a fall which happened to the mother, the foal was hurt, and died an hour after birth; and that its ſkin, according to his information, was tranſmitted to Dr MATTY, then ſecretary to the Royal Society of London †. M. DE BUFFON mentions ſeveral examples of the ſame kind from Spain and Italy, though he acknowledges that they are not ſo well atteſted as the former ‡. From theſe facts he concludes that hybrids, or mules, produced even from the moſt comparatively unprolific quadrupeds, are not abſolutely barren.

M. DE BUFFON farther remarks, that 'mules never produce in 'cold climates, ſeldom in warm regions, and ſtill more ſeldom in 'temperate countries §.'

The inſtances of prolific powers in mules, properly authenticated, are indeed few. But this circumſtance is perhaps more owing to the prejudices and to the indolence of mankind than to the actual ſterility of the animals. Even in our own country, we have lately had an inſtance of the prolific powers of a ſhe-mule. She was impregnated ſpontaneouſly by a horſe, and produced a very ſtrong foal. The animal, however, was allowed to periſh from a ſuperſtitious notion, that it was an ominous monſter, and would bring diſcredit to the farmer's cattle, as well as to thoſe in his neighbourhood. This event happened in the county of Forfar, which is ſituated in the north of Scotland. Though I publiſhed an authenticated account of this uncommon fact in the eighth volume of my Tranſ-

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* Buffon, Supplem. à l'Hiſt. des Quadrup. p. 16, 17. and Tranſlat. Vol. VIII. p. 15.

† Ibid. p. 18. and Tranſlat. Vol. VIII. p. 16.

‡ Ibid. and Tranſlat. Vol. VIII. p. 17.

§ Ibid. p. 19. and Tranſlat. Vol. VIII. p. 18.

Tranſlation of Buffon, it will not be improper, for the ſatisfaction of my readers, to ſubjoin, verbatim, the authentication in a note *.

Birds,

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* Having heard that a mule, belonging to Mr David Tullo, farmer in Auchtertyre, in the county of Forfar, had, ſome years ago, brought forth a foal, I tranſmitted a few queries to be put to Mr Tullo; and requeſted that his anſwers might be legally atteſted by a magiſtrate. This requeſt was chearfully complied with; and the following is an exact copy of the queries, anſwers, and atteſtations.

Interrogatories to be put to Mr Tullo, tenant in Auchtertyre, pariſh of Newtyle, and county of Forfar, with his anſwers thereto.

1mo, Had you ever a ſhe-mule? At what period? Is it true that the mule had a foal? At what time was ſhe covered; and when did ſhe foal?

Anſwered by Mr Tullo: That he bought a ſhe-mule about twenty years ago: That ſhe was conſtantly in ſeaſon for a horſe: That, about ſome years thereafter, he gave her a horſe; and that ſhe, thereafter, gave him a foal about the 10th of June. The mule's price was four pounds five ſhillings Sterling.

2do, What was the colour of the foal? Was there any thing particular in its figure?

Anſwer: The foal was exactly the colour of its mother, inclined to black, with a very large head, big ears, and ſmall tail; and the declarant thinks, had its head been weighed when foaled, it would have weighed nearly as much as its body.

3tio, How long was the animal allowed to live?

Anſwer: The next day after the mule foaled, it was ſent, with its mother, to the Loch of Lundie, in order to let the foal die, as the declarant could not want the mule's work, and the mother ſeemed not fond of the foal: That it was accordingly left, and next day came to Auchtertyre, about two miles diſtance, over a hill, with the cattle of Auchtertyre, that had been grazing near to that place, and was drowned in a ditch the day following.

4to, Was its ſkin preſerved, or the head, or any other bones of the ſkeleton? Could any part thereof be ſtill found?

Anſwered:

Birds, in general, are more prolific, and likewiſe more ardent in their amours, than quadrupeds. A cock, when excluded from hens, attacks another cock, a capon, a turkey, or a duck. The ſmaller birds fly to females of a different ſpecies when deprived of their own. Commixtures of this latter kind have been repeatedly tried, and the mongrel offspring, inſtead of being barren, were found to be equally prolific as their parents. The goldfinch and Canary bird, the red-breaſted

Anſwered: Neither the ſkin, nor any part of the ſkeleton was preſerved, nor can now be had; though the declarant has often regretted the not preſerving the foal, as its mother always performed any work that a horſe of fifteen pounds value could do.

5*to*, Is the mother ſtill alive? What is her age?

Anſwer: The mother died, about eight years ago, of an epidemic cold that was raging among the horſes in this country: The mule had little or no milk after foaling, and the foal got ſome cow's milk: And this is all he remembers of the matter.

David Tullo.

Auchtertyre, 4th February 1780.

We James Small tenant in Burnmouth, and Robert Ramſay tenant in Newtyle, hereby certify, That we have often ſeen the mule above deſcribed, and we know that ſhe had a foal, as is narrated by David Tullo.

James Small.
Rob. Ramsay.

Ballantyne-houſe, 4th February 1780.

The within interrogatories were put to David Tullo, tenant in Auchtertyre, anent the mule he had, and the foal ſhe produced, to which he gave the anſwers ſubjoined to each query, and ſigned them, as did James Small and Robert Ramſay, atteſting the truth thereof, in preſence of

George Watson, J. P.

The original atteſtation is in my poſſeſſion; and I lately tranſmitted notorial or authenticated copies of it to the Count de Buffon, and to Thomas Pennant, Eſq; of Downing in Flintſhire.

breaſted and common linnet, have been ſubjected to theſe trials, and the hybrids or mules produced by them uniformly retained their prolific powers*.

I cloſe this ſection with remarking, that Nature ſeems to indulge more frolics in the myſteries of Venus than philoſophers are apt to imagine; and that ſome animals whom we are taught to regard as diſtinct and original ſpecies, may only be mules endowed with the faculty of tranſmiſſion.

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* See Buffon des Oiſeaux, Tom. I. p. 22. and Tom. IV. Art. du Serin des Canaries.

SECT. II.

Of a Plan for raiſing the raw material of Silk *in Britain—The texture of Inſects is extremely ductile—From many circumſtances in their hiſtory, it ſhould appear that different kinds intermix, and produce new and fertile ſpecies—Upon this view of Nature, a probable plan for producing the raw material of a Silk Manufacture in Britain is ſubmitted to the conſideration of the Public—The experiment is eaſy, attended with no expence, and highly worthy of a trial.*

INVENTION is often the offspring of accident: But prejudice, or fixed opinion, is an inſurmountable barrier to every invention that depends upon a proceſs of reaſoning. A mind, fettered by a ſtrong predilection for particular notions, can never move with freedom, or view objects in different aſpects; and, of courſe, has not even the chance of ſtumbling on novelty. Unfortunately for ſcience, this is a very general characteriſtic of the human ſpecies. We are gregarious animals, not in the phyſical ſenſe alone: With regard to opinion and belief, this herding quality is a more ſtriking feature in the complexion of humanity. Strongly impreſſed with the force of this truth, ſome philoſophers run into the oppoſite extreme. Becauſe moſt men believe without reaſon, there are others whom no reaſoning can convince. Between the two ingenuous minds are confounded, ſubjects of moment are conſidered either as inſcrutable or as perfectly known, and the ſpirit of reſearch receives a mortal wound.

To give general currency to a hypothetical notion, requires only the adventitious aid of a few great names. If, upon this ſlight baſis, the fabric reſts for a few years, ingenuity, argument, and even experiment, may open their ineffectual batteries. Such is the incorrigible attachment to what men call *authorities*, that nothing but *greater authorities* can eradicate an eſtabliſhed prejudice. This temper, which originates from weakneſs, credulity, and indolence, is perhaps the greateſt obſtruction that ſcience has to encounter in its progreſs toward perfection. Hence the man who refutes a received theory does more ſervice to ſcience than its inventor; becauſe he unſhackles the mind, and freſh inquiries proceed without embarraſſment. New views, for the ſame reaſon, which require the illuſtration of experiment, are of the greateſt utility; for, though the notions ſhould turn out to be falſe, unlooked for truths riſe up in the courſe of the reſearch. Notwithſtanding HARVEY's ſyſtem of *eggs*, LEUWENHOEK's *homunculi*, BUFFON's *living organic particles*, and BONNET's *infinite ſeries of germs*, the theory of generation is ſtill involved in the deepeſt obſcurity; yet the inquiry has enriched anatomy and ſcience with many new and valuable facts.

Becauſe mules from the aſs and mare were ſuppoſed to be barren, it has been concluded, and even recognized as a law of Nature, that every anomalous production muſt likewiſe be denied the faculty of procreating. The wiſdom of the Creator has been celebrated in the eſtabliſhment of this law. It has been regarded as a barrier againſt the mixture and confuſion of ſpecies; and the ſacredneſs of the imaginary inſtitution has almoſt totally precluded all inquiry into the ſubject.

The ingenious M. de Buffon, however, ventured to inveſtigate the truth. He brought direct evidence, that the common mule, a production from two of the moſt unprolific quadrupeds, is not deprived of the power of multiplying. Even in our own climate, we had lately an inſtance of a prolific ſhe-mule *.

By revolving theſe and ſimilar ideas, I was led to the following views, which, with much deference, I ſubmit to the attention of the public. For the ſake of brevity, I ſhall deliver moſt of them in the form of queries.

I. As we are ignorant of many circumſtances in the œconomy of animals, and, as it is certain, that mongrels from the commixture of different ſpecies of ſmall birds have the power of tranſmitting the kind, may we not conclude, that the ſuppoſed law of ſterility in mules is at leaſt not ſo general as we have been taught to believe?

II. As the experiments have hitherto been confined to the moſt ſterile quadrupeds, may we not reaſonably expect, that trials made upon the more prolific animals, as the ſow, the rabbit, &c. would afford ſtill farther proofs of the fœcundity of anomalous beings?

III. Deſcending lower in the ſcale of animation, till we come to frogs, lizards, and the reptile race, whoſe prolific powers are amazing, and in whom Nature aſſumes a more ſoft and ductile texture, may

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* See p. 145.

may we not hope to procure multitudes of mules endowed with the faculty of tranſmiſſion?

IV. Proceeding ſtill lower, till we arrive at the inſect tribes, do not ſimilarity of texture, aſtoniſhing fertility, the ſame mode of generating, a great coincidence in the ſtructure of parts, both external and internal, the living on the ſame or ſimilar nouriſhment, and many other circumſtances, concur in marking them out as the fitteſt objects for trials of this kind, and from which the greateſt ſucceſs is to be expected?

The chief obſtruction to the execution of trials of this nature ariſes from the difficulty of alluring different ſpecies into mutual and ardent embraces. In one tribe of inſects, however, I imagine, that this difficulty will be completely removed. The numerous tribe of butter-flies, after eſcaping from the chryſalis ſtate, ſeem to have no other deſtination but that of propagating and continuing the kind. They no ſooner burſt through the fetters of the chryſalis, than they roam about in queſt of a mate with all the fervours of deſire. When they meet their object, they obey with alacrity the commands of Nature. After the operation is finiſhed, the female lays her eggs, and the male acquires a torpid aſpect. The intention of Nature being thus compleated, both male and female fall victims at the altar of Venus.

As butterflies die very ſoon after procreating, and, as they have few other deſires while in that ſtate, is it not probable, that, when excluded from their particular kinds, males and females of different ſpecies will ſpontaneouſly unite? From this union, is it not likewiſe probable, that the eggs of the females will be impregnated?

From the accurate diſſections of the celebrated REAUMUR, it appears, that the parts of generation in the various kinds of butterflies are extremely ſimilar. From the ſeveral metamorphoſes to which they are ſubjected, the ductility of their texture is alſo apparent. When, to theſe facts, we add their great prolific powers, is it not reaſonable to ſuppoſe, that anomalous productions from different ſpecies will continue to be fertile?

This reaſoning may eaſily be ſubjected to the teſt of experiment. Let any perſon feed a variety of caterpillars in ſeparate boxes. When transformed into moths or butterflies, let the males and females of different ſpecies be admitted to each other. The effects of theſe trials time alone can determine. If it happens, as there is great reaſon to expect, that theſe inſects freely unite; that the eggs of the females are impregnated by this union; and that the ſpurious offspring are endowed with prolific powers, and perpetuate the kind, then will philoſophers have the ſatisfaction of ſeeing an univerſal prejudice, concerning the oeconomy of animals, completely removed.

The mere gratification of curioſity would juſtify a ſet of experiments that require ſo little time, trouble, or expence *. But the idea of utility gives alacrity to inveſtigation. Conſidering whether ſome uſe might not be derived from theſe projected trials upon butterflies, the following notion, which, perhaps, may be regarded as fanciful, occurred.

The ſilk worm is a native of warm climates. Its conſtitution is too

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[*] About fourteen years ago, I attempted to make theſe experiments. But, from my ſituation in a large city, and the want of proper food, I found that my ſilk worms died before they arrived at maturity.

too delicate to bear the cold and the viciſſitudes of our weather. Neither is the mulberry, the proper food of the animal, raiſed here in ſufficient quantities. Theſe are the chief obſtructions to the culture of ſilk in this country. But large ſums of money are annually ſent out of Britain for purchaſing raw ſilk. Hence any rational ſcheme for preventing this expenditure merits the attention both of philoſophers and of the public. I deſpair not of ſeeing this deſirable end accompliſhed. I even look forward with joy to a period, which I hope is not diſtant, when the production of good ſilk will be as common in Scotland as in any other nation in Europe, or Aſia.

The mode I propoſe is ſimple; and therefore its ſucceſs is the more probable. In this country, we have many caterpillars which ſpin pods of no inconſiderable ſize and goodneſs. A caterpillar that feeds upon the pear-tree, and is produced from the fly called *Phalaena pavonia*, or *peacock-moth*, ſpins a large pod, the ſilk of which is coarſer and ſtronger than common ſilk. Another ſpecies, called by the French *la livrée*, feeds on the leaves of moſt fruit trees, and ſpins a pod extremely ſimilar to that of the ſilk worm. Other caterpillars, poſſeſſing the ſame qualities, live upon the oak, the elm, the plane, &c. But it is needleſs to give a more enlarged enumeration. Now, commixtures with the butterflies of theſe caterpillars and the ſilk-fly will, I imagine, produce worms attempered in conſtitution to the climate of Britain, capable of being nouriſhed by ſome of our indigenous plants, endowed, at the ſame time, with the faculty of perpetuating the kind, and of ſpinning a ſilk equal, if not ſuperior, to that imported from warmer regions.

To this ſcheme it may be objected, that, on the ſuppoſition of its practicability, the ſpecies of butterflies ſhould be perpetually augmenting,

menting, and that to their variety there ſhould be no end. I anſwer, that this objection ſtrengthens the probability of the plan: For the varieties of the butterfly and moth, already known and deſcribed, amount nearly to 1000. Many of theſe, I doubt not, have been produced by accidental commixtures. Two cauſes concur in preventing ſuch a frequency of commixtures of this kind as might be imagined. Many ſpecies of caterpillars aſſociate, and fix their chryſales upon particular plants or places, and, immediately after their metamorphoſis, the males attach themſelves to the females. Other ſpecies not only aſſociate, but eſcape from the chryſalis in particular months of the year, as if Nature meant to prevent their uniting. Some kinds come out only in April, others in May, June, July, Auguſt, and September. Theſe and other circumſtances render the accidental concourſe of males and females of different ſpecies much leſs frequent than if all the kinds lived at the ſame time, and fed upon the ſame plants.

It may likewiſe be objected, that, as different ſpecies are transformed in different months, and as the flies die ſoon after their change, it will be impoſſible to try theſe projected experiments with kinds which come out of the chryſalis ſtate at the diſtance of one or two months from each other. This objection is removed by two ſingular facts. It is true, that coition debilitates and quickly kills butterflies. But, when confined, and prevented from mutual embraces, they preſerve both their exiſtence and vigour for five or ſix months *. Beſides, from the accurate experiments of REAUMUR, we learn, that the duration of the chryſalis ſtate may be prolonged

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* Wahlbom in Amoen. Acad. Vol. I. p. 105.

or ſhortened at pleaſure, by the application of different degrees of heat and cold *.

Upon the whole, I moſt ſeriouſly recommend this idea to the attention of men who have leiſure, and who are properly ſituated, to give the project a fair trial. If my ideas be right, the perſon who realiſes them will not only make a fortune, but immortaliſe his name.

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* Reaumur, Tom. III. 12mo. edit. p. 11.

CHAPTER IV.

Of the Varieties of Man which have hitherto been diſcovered in every region of the Globe—Varieties in Colour—in Stature—in Figure and Features—in Manners and Cuſtoms—in Religion, and Religious Opinions and Ceremonies—Of Cannibals both ancient and modern—Of Human Sacrifices in the Old and New Worlds—Of War and Warlike Inſtruments—Of Agriculture, and the Spontaneous Productions of the Earth—Of Marriages, Burials, Civil Government, Arts and Manufactures, &c. &c.

WITH regard to colour, in the human ſpecies, from black it runs through almoſt every poſſible ſhade till it arrives at what we denominate *white*. Many circumſtances give riſe to differences in the colour of the ſkin. Even in the ſame climate, in the ſame town or village, marked ſhades of colour are to be obſerved not only in individuals, but in whole families, and theſe ſhades are generally tranſmitted to poſterity, except when the breed happens to be croſſed by races of individuals of a different complexion, which produces an intermediate ſhade. In a large city, independent of foreign commixtures, what a variety of colours are to be perceived?

Notwithſtanding theſe local, and often hereditary ſhades, which take place in the ſame climate, and even in a ſmall diſtrict of the ſame country, Nature, from particular ſituations as to heat and cold, produces diſtinctions of the moſt marked kinds.

In the Old Continent, however, the deepeſt ſhade of black is to be found in the Torrid Zone. From this region of the earth, as we approach either to the ſouth or north, the colour of the human kind gradually becomes more and more white, till we arrive at the temperate climates, where the complexion, to our eyes, at leaſt, is moſt beautiful. But our ideas of beauty are entirely relative. To a negroe, the deepeſt black is the moſt admired colour in a female; and the ſame ſentiment is and muſt be entertained by people of all intermediate colours.

In proportion as we recede from the equator, either to the ſouth or the north, the ſhades of colour become always whiter and whiter. But here Nature, correſpondent to her uniform procedure, reverſes, or rather confirms, her original plan. From the negroes under or near the line, to the termination of the temperate zone, the gradations of colour are to be aſcertained. But, what is ſingular and curious, after paſſing north of the temperate zone, the colour of the natives is not only more ſwarthy, but again approaches to blackneſs. From this fact, which is perfectly known, it ſhould ſeem, that extreme heat and extreme cold produce nearly the ſame appearances on the human ſkin.

The inhabitants of Lapland and of Nova Zembla, the Borandians, the Samoiedes, the northern Tartars, the Oſtiacks, the Greenlanders, and the ſavages to the north of the Eſquimaux Indians, ſeem to be the ſame race of people. All of them have broad large faces, and flat noſes *. Their eyes are of a yellowiſh brown colour, inclining to black †. Theſr eye-lids extend towards the temples; their cheek-bones are remarkably prominent; their mouths are large, and their lips thick and reflected; their voice is ſqueaking; their head is large; their hair black and ſmooth; and their ſkin is of a tawny or ſwarthy hue. Their ſize is diminutive, moſt of them not exceeding four feet high; and their talleſt men are not above four feet and a half. This numerous race of people differ ſo much from all others, that they appear to conſtitute a diſtinct ſpecies. The Borandians are ſtill ſmaller than the Laplanders. The iris of their eyes is of the ſame colour; but the white is of a reddiſh yellow. Their ſkin is more tawny; and their legs are very thick and ill-ſhaped.

The Samoiedes are more ſquat than the Laplanders; their heads are larger, their noſes broader, their complexion darker, their legs ſhorter, and their beards more ſcanty of hair. The ſkin of the Greenlander is more tawny than that of the other nations, being of a deep olive colour. It is even ſaid, that ſome of them are as black as the African negroes. The women, among all theſe nations, are as ugly as the men, and reſemble them ſo much, that the diſtinction is not eaſily to be perceived. In Greenland, the women are very ſhort; but their bodies are well proportioned. Their hair is blacker, and their ſkin ſofter than thoſe of the Samoiedes. Their breaſts are ſo long and flexible, that they can ſuckle their children over their ſhoulders. Their nipples are as black as jet, and their ſkin is of a deep olive colour. Their viſage is large, their eyes ſmall, but black and vivacious, and their feet and hands are ſhort. In all other reſpects,

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* Le Voyage de Regnard, tom. I. p. 169. et Les Voyages du Nord faits par les Hollandois.

† Linnaei Fauna Suecica, 1746, p. 1.

reſpects, they reſemble the Samoiede females. The ſavages north of the Eſquimaux, and even in the northern parts of Newfoundland, have a great reſemblance to the Greenlanders. Like them alſo, their ſtature is ſmall, their faces broad, and their noſes flat. Their eyes, however, are larger than thoſe of the Laplanders.

All thoſe races reſemble each other not only in deformity, in lowneſs of ſtature, and in the colour of their hair and eyes, but likewiſe in their diſpoſitions and manners. All of them are equally groſs, ſtupid, and ſuperſtitious. The Daniſh Laplanders keep large black cats, to whom they communicate their ſecrets, and conſult in all their important affairs. In every family, among the Swediſh Laplanders, a drum is kept for the purpoſe of conſulting the devil; and, though they are robuſt and nimble, ſuch is their puſillanimity, that they never could be perſuaded to face a field of battle. Guſtavus Adolphus attempted to embody a regiment of Laplanders; but he was obliged to relinquiſh the project. They cannot, it would appear, exiſt any where but in their own country, and in their own manner. They travel on the ſnow with ſkates made of wood, about two yards long, and half a foot in breadth. With theſe they run on the ſnow ſo rapidly, that they overtake eaſily the ſwifteſt animals. They uſe a long pole, pointed with iron at one end, and rounded at the other. By means of this pole, they puſh themſelves forward, direct their courſe, prevent their falling, ſtop their impetuoſity, and kill the animals they purſue *. The ſkates employed by the Samoiedes are ſhorter, ſeldom exceeding two feet in length. They likewiſe uſe the bow and the croſs-bow; and the Muſcovite Laplanders are ſaid to dart a javelin with ſuch force and dexterity, that, at

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* A ſpecimen of theſe ſkates may be ſeen in the Muſaeum of the Antiquaries of Scotland.

at the diſtance of thirty paces, they often hit a mark not larger than a crown piece. They hunt the lynx, the fox, the martin, and the ermine, and barter their ſkins for brandy and tobacco. Their principal food is dried fiſh, and the fleſh of the bear and rein-deer. Their bread conſiſts of the pounded bones of fiſhes, mixed with the tender bark of the birch or the pine tree. Their common drink is whale-oil, or water in which the berries of the juniper have been infuſed. They are, in general, idolaters and extremely ſuperſtitious. More groſs than ſavages, they have neither courage nor a ſenſe of ſhame. They bathe promiſcuouſly naked, boys and girls. mothers and ſons, brothers and ſiſters, without feeling the ſmalleſt ſenſe of impropriety. They offer their wives and daughters to ſtrangers, and think it the higheſt affront if the offer be rejected. This cuſtom is univerſal among the Samoiedes, the Borandians, the Laplanders, and the inhabitants of Greenland. The Laplanders, in winter, clothe themſelves with the ſkin of the rein-deer, and, in ſummer, with the ſkins of birds.

In Nova Zembla, the women pierce their noſes and ears, and ornament them with pendants of blue ſtones; and, to augment their charms, they draw blue lines acroſs their forehead and chin. In Greenland, the women clothe themſelves with the ſkin of the dog-fiſh. They likewiſe paint their faces blue and yellow, and wear pendants in their ears. All of them live under ground, or in huts ſunk almoſt below the ſurface, which they cover with the bark of trees, or with the bones of fiſhes. During winter, it is a common practice with them to make ſubterraneous communications from one habitation to another, by which they are enabled to viſit their neighbours without going abroad. Darkneſs, continued for ſeveral months, obliges them to illuminate their dreary abodes with lamps, in which they burn the ſame whale-oil that they uſe for their common drink. In ſummer, they ſeem to have as little enjoyment as in winter; for they are obliged to live perpetually in a thick ſmoke. They have no other contrivance to guard themſelves againſt the bite of the gnats, and various other flies, which are extremely numerous, becauſe their ſummer is ſo ſhort, that flies of every ſpecies appear nearly at the ſame time, and crowd the air. Notwithſtanding this melancholy and hard mode of living, theſe people are ſeldom ſick, and almoſt all of them arrive at extreme old age. The men, even when old, are ſo vigorous, that they are not eaſily to be diſtinguiſhed from the young. Blindneſs, a natural conſequence of their ſituation, is very frequent among them, and is the chief malady to which they are ſubjected. Their eyes being perpetually dazzled with the reflection from the ſnow in winter, autumn, and ſpring, and at all ſeaſons involved in ſmoke, few of them retain their ſight after an advanced period of life.

From theſe and ſimilar facts, it appears, that the Samoiedes, the Zemblians, the Borandians, the Laplanders, the Greenlanders, and the ſavages to the north of the Eſquimaux, belong to the ſame race of men; becauſe they reſemble each other in figure, in ſtature, in colour, in manners, and in cuſtoms. That very ſtrange cuſtom of offering their wives and daughters to ſtrangers, and of being vain when the offer is accepted, proceeds, probably, from a ſenſe of deformity both in themſelves and in their females. In the neighbouring nations, on the contrary, as thoſe of China and Perſia, where the women are moſt beautiful, the jealouſy of the men is remarkable. Upon ſurveying the different nations adjacent to that vaſt tract of country occupied by the Laplanders, there ſeems to be no relation between them and the race laſt mentioned. The Oſtiacks and the

Tonguſians, who are adjacent to the Samoiedes on the ſouth and ſouth-eaſt, are the only people who have any marked reſemblance to them. The Samoiedes and Borandians have no ſimilarity to the Ruſſians. The Laplanders reſemble not, in any degree, the Fins, the Goths, the Danes, or the Norwegians. The Greenlanders differ totally from the ſavages of Canada, who are large and well made. The Oſtiacks, however, ſeem to be a leſs ugly, and a taller branch of the Samoiedes *. The Oſtiacks feed upon raw fleſh or fiſh. They eat every kind of animal without diſtinction; and for drink they prefer blood to water. They are, in general, idolaters; and they appear to form the line which ſeparates the Lapponian and Tartarian races. The Tonguſians ſeem to be leſs degenerated than the Oſtiacks; for, though ugly, they are taller and better proportioned. The Samoiedes and Laplanders lie under the 68th or 69th degree, but the Oſtiacks under the 60th. The Tartars, who are ſituated along the Wolga, in the latitude of 55, are a groſs, ſtupid, and brutal people. Like the Tonguſians, they have no ideas of religion; and they will not marry young women till they have had intercourſe with other men.

In Aſia, the Tartars occupy vaſt regions. They ſpread over that great tract of country which extends from Ruſſia to Kamſchatka. The Tartars border with China, the kingdoms of Bouton, and of Alva, and the Mogul and Perſian empires, as far as the Caſpian ſea, on the north and weſt. They extend along the Wolga and the weſt coaſt of the Caſpian, as far as Dagheſtan. They have penetrated to the north coaſt of the black ſea, and have eſtabliſhments in the Crimea, in Little Tartary, and in the Ukraine. Theſe people, even

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* Le Voyage de Evertiſbrand, p. 212. les nouveaux Mem. ſur l'etat de la Ruſſie, Tom. I. p. 270.

when young, have large wrinkled foreheads; their noſes are broad and ſhort, and their eyes ſmall and ſunk*. Their cheek bones are high, and the lower part of their face is very narrow. Their chin is long and prominent, and the upper jaw falls in. The teeth are long and diſtinct from each other. The eye-brows are ſo thick, that they cover the eyes; the face is flat, the ſkin tawny, and the hair black. Their bodies are of a middle ſize, but ſtrong and robuſt. Their beards are ſcanty, and the hairs are diſpoſed in tufts, like thoſe of the Chineſe. There is ſomething frightful in the countenances of the Calmuck Tartars. All of them are wandering vagabonds, and live in tents made of cloth, or of ſkins. They eat the fleſh of horſes, either raw, or a little ſoftened by putrifying under their ſaddles. They likewiſe eat fiſhes dried in the ſun. Mares milk, fermented with the flour of millet, is their uſual drink. They all ſhave the head, except a ſmall tuft, which is allowed to grow, in order to form two treſſes, one of them to hang on each ſide of the face. The women, who are as ugly as the men, wear their hair, in which they fix ſmall pieces of copper, and ſimilar ornaments.

No marks of religion, or of decency in their manners, are to be found among moſt of theſe tribes. They are all robbers; and the Tartars of Dagheſtan, who border on civilized nations, have a great trade in ſlaves, whom they carry off by force, and ſell to the Perſians and Turks. Their chief wealth conſiſts of horſes, which ſeem to be more numerous in Tartary than in any other country. The Tartars live perpetually with their horſes, and are continually occupied in training, dreſſing, and exerciſing them. They manage their horſes with ſuch ſkill and addreſs, that a ſtranger would be apt to imagine that both creatures were animated by the ſame mind.

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* Vid. les Voyages de Rubruſquis, de Marc Paule, de Jean Struys, du Pere Avril, &c.

To know the particular diſtinctions which ſubſiſt among the race of Tartars, we muſt attend to the deſcriptions of their different tribes communicated to us by travellers. **Tavernier** informs us, that the Calmucks, who live in the vicinity of the Caſpian Sea, between Muſcovy and Great Tartary, are a robuſt people, but, perhaps, the moſt ugly and deformed beings exhibited upon this earth. Their faces are ſo broad and ſo flat, that their eyes, which are ſmall, are ſituated five or ſix inches aſunder. Their noſes are ſo depreſſed, that, inſtead of regular noſtrils, two holes are only to be ſeen. Their thighs bend outward, and their legs inward.

After the Calmucks, the Tartars of Dagheſtan may be conſidered as holding the next rank in deformity. The Little Tartars, or thoſe of Nogai, who live in the neighbourhood of the Black Sea, though they have flat faces, ſmall eyes, and, in their general figure, reſemble the Calmucks, are by no means ſo ugly. This race of Tartars have probably loſt a part of their original deformity by their intercourſe with the Circaſſians, the Moldavians, and other adjacent nations. Like the Calmucks, the Siberian Tartars have broad faces, ſhort flat noſes, and ſmall eyes; and though their languages greatly differ, their general ſimilarity is ſo ſtriking, that they ought to be regarded as the ſame race of people. **Pere Avril** conſiders the Tartars of Bratſki as of the ſame race with that of the Calmucks; and, as we advance eaſtward, and approach Independent Tartary, the features of the Tartars gradually ſoften and become more agreeable; but their eſſential characteriſtics are never obliterated. The Mongou Tartars, who conquered China, are the moſt poliſhed race of theſe people. Still, however, like all the other tribes, their eyes are ſmall, their faces broad and flat; and they have thin black or red beards [*], ſhort when young, have large wrinkled foreheads; their noſes are broad and ſhort, and their eyes ſmall and ſunk *. Their cheek bones are high, and the lower part of their face is very narrow. Their chin is long and prominent, and the upper jaw falls in. The teeth are long and diſtinct from each other. The eye-brows are ſo thick, that they cover the eyes; the face is flat, the ſkin tawny, and the hair black. Their bodies are of a middle ſize, but ſtrong and robuſt. Their beards are ſcanty, and the hairs are diſpoſed in tufts, like thoſe of the Chineſe. There is ſomething frightful in the countenances of the Calmuck Tartars. All of them are wandering vagabonds, and live in tents made of cloth, or of ſkins. They eat the fleſh of horſes, either raw, or a little ſoftened by putrifying under their ſaddles. They likewiſe eat fiſhes dried in the ſun. Mares milk, fermented with the flour of millet, is their uſual drink. They all ſhave the head, except a ſmall tuft, which is allowed to grow, in order to form two treſſes, one of them to hang on each ſide of the face. The women, who are as ugly as the men, wear their hair, in which they fix ſmall pieces of copper, and ſimilar ornaments.

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[*] Palafox, p. 441.

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* Palafox, p. 441.

Mr Sanchez, firſt phyſician to the Ruſſian army, a man of learning and ability, communicated to the Count de Buffon ſome remarks made by him, in travelling through Tartary, of which the following is the ſubſtance.

Mr Sanchez, in the years 1735, 1736, and 1737, viſited the Ukraine, the banks of the Don as far as the ſea of Zabach, and the confines of Cuban, till he arrived at Aſoph. He travelled over the deſarts which lie between the country of the Crims and Backmut. He journeyed among the wandering Calmucks from the kingdom of Caſan to the banks of the Don, among the Tartars of Crimea and Nogai, and likewiſe among the Tartars of Kergiſſi and Tcheremiſſi; who are ſituated to the north of Aſtracan, from the 50th to the 60th degree of latitude. He informs us, that the Tartars of Crimea and of Cuban were of a middle ſtature; and that they had broad ſhoulders, narrow flanks, ſtrong nervous limbs, black eyes, and a tawny complexion. The Tartars of Kergiſſi and Tcheremiſſi are ſmaller and more ſquat; they are groſſer and leſs agile; their eyes are black; their complexion tawny, and their faces are ſtill broader than thoſe of the former. Among theſe Tartars, he obſerved ſeveral men and women who had no reſemblance to the natives, ſome of whom were as white as the inhabitants of Poland. As theſe nations abound with both male and female ſlaves, who are carried off from Ruſſia and Poland; as a plurality of wives and concubines is permitted by their laws; and, as their Murzas, or nobles, bring their wives from Georgia and Circaſſia, the children produced by theſe alliances are whiter, and leſs deformed than thoſe of the unmixed natives. Among the Tartars, there is even a whole nation, that of the Kabardinſki, the inhabitants of which are remarkably beautiful. M. SANCHEZ ſaw no leſs than three hundred of theſe men in the Ruſſian ſervice; and he aſſures us that they made a very handſome appearance. Their countenances were as white and freſh as any in Europe: They had large black eyes; and they were tall and well proportioned. He adds, that the Lieutenant-General of Serapikin, who had lived long in Kabarda, informed him, that the women were equally beautiful. This nation, however, M. SANCHEZ tells us, are ſaid to have come originally from the Ukraine, and had been tranſported into Kabarda about an hundred and fifty years ago.

On one ſide, the blood of the Tartars is mixed with that of the Chineſe, and, on the other, with that of the oriental Ruſſians. But this mixture never obliterates entirely the characteriſtic features of the race; for, among the Muſcovites, the Tartarian aſpect is not unfrequent; and, though the former have originated from the common European race, many individuals with ſquat bodies, thick thighs, and ſhort legs, like thoſe of the Tartars, are ſtill to be found. But the reſemblance of the Chineſe to the Tartars is ſo great, that it is uncertain whether they belong not to the ſame race. The moſt ſtriking difference between thoſe people ariſes from a total diſparity in their diſpoſitions, manners, and cuſtoms. The Tartars are warlike, fierce, and fond of hunting. They love exerciſe and independence; and they are hardy and brutally groſs. The manners of the Chineſe are totally oppoſite; for they are effeminate, peaceable, indolent, ſubmiſſive, ſuperſtitious, ceremonious, and paraſitical. In their form and features, however, they greatly reſemble the Tartars.

It is remarked by **HUGON**, that the Chineſe men are large and fat, with well-proportioned limbs, round broadiſh faces, ſmall eyes, large eye-brows, high eye-lids, and ſmall ſunk noſes. They have ſeven or eight tufts of hair only on each lip and very little on the chin. Thoſe who inhabit the ſouthern provinces are more brown and tawny than thoſe in the northern parts; and, in colour, they reſemble the people of Mauritania, or the moſt ſwarthy of the Spaniards. In the middle provinces, however, they are as white as the Germans. **DAMPIER** informs us, that in the iſland of St John, on the coaſt of China, the natives are tall, erect, and not incumbered with fat; that they have long viſages and high foreheads; that their eyes are ſmall, their noſe pretty large and elevated, their mouth of a moderate ſize, their lips thin, their complexion aſh-coloured, and their hair black; that their beard is naturally ſcanty; and that they pull out all the hairs, except a few on the upper lip and chin. **GENTIL** tells us, that the Chineſe, eſpecially in the northern provinces, have nothing diſagreeable in their aſpect. Thoſe, indeed, in the ſouthern provinces, whom neceſſity expoſes much to the ſun, are tawny. They have, in general, ſmall oval eyes, ſhort noſes, and thick bodies of a middle ſtature. The women, he aſſures us, employ every art in order to diminiſh their eyes. For this purpoſe, the young girls, inſtructed by their mothers, extend their eye lids continually, with the view of making their eyes oblong and ſmall. Theſe properties, in the eſtimation of the Chineſe, when joined to a flat noſe, and large, open, pendulous ears, conſtitute the perfection of beauty. He adds, that their complexions are fine, their lips of a beautiful red colour, their mouths well ſhaped, and their hair exceedingly black; but that their teeth are blackened by chewing betle; and their conſtant practice of painting injures their ſkin to ſuch a degree, that they have the appearance of old age before they reach their thirtieth year.

PALAFOX aſſures us, that the Chineſe exceed the oriental Tartars in whiteneſs; that they have alſo ſmaller beards; but that, in every other reſpect, there is little difference in the countenances of theſe two nations. INNIGO BIERVILLAS tells us, that the Chineſe women are formed with more ſymmetry than the men. The faces of the latter, he remarks, are large, and their complexions of a yellowiſh hue; their noſes are broad and flattened; and their bodies are thick and coarſe. On the contrary, the women are exceedingly handſome; their complexion and their ſkin are very fine; and their eyes are beautiful. He adds, that few of them have good noſes, becauſe, from ſome prejudice, they are artificially compreſſed during infancy. Almoſt all the voyagers agree, that, in general, the Chineſe have broad faces, ſmall eyes, and hardly any beard; that the natives of Canton, and along the ſouthern coaſt, are as tawny as the inhabitants of Fez in Africa; but that thoſe of the interior provinces are commonly white. From theſe and ſimilar facts, it is apparent that there are great ſimilarities between the Tartars and Chineſe. To confirm this idea, we ſhall ſubjoin the following paſſage from Chardin: ‘ The ſize of the Little Tartars,’ he remarks, ‘ is about four ‘ inches ſmaller than that of the Europeans; and, in the ſame pro‘ portion, they are thicker. Their complexion is copper-coloured; ‘ their faces are broad, flat, and ſquare; their eyes are ſmall, and ‘ their noſes compreſſed. Now, theſe are the exact features of the ‘ Chineſe; for, after the moſt minute inveſtigation, during my tra‘ vels, I found that all the people to the eaſt and north of the Caſ‘ pian Sea, and to the eaſt of the peninſula of Malacca, have the ‘ ſame configuration of face, and nearly the ſame ſtature. From 'this circumſtance I was induced to think that all theſe people, notwithſtanding the varieties in their manners and complexion, ſprung 'from the ſame ſource; for differences in colour proceed entirely 'from climate and the manner of living; and varieties in manners 'originate from the ſoil, and from the degrees of opulence enjoyed 'by different nations *.'

We are informed by Father PARENNIN, who reſided long in China, and diligently obſerved the manners of that people, that the neighbouring nations on the weſt, from Thibet to Chamo, differed from the Chineſe in language, features, external conformation, and manners; that they are rude, ignorant, and ſlothful, faults by no means common among the inhabitants of China; that, when any of theſe Tartars come to Pekin, and are aſked by the Chineſe the reaſon of theſe differences, they anſwer, that theſe are occaſioned by the ſoil and the water. PARENNIN adds, that this remark ſeems to be more verified in China than in any other country he ever viſited; and that, when following the Emperor in an excurſion to Tartary, as far as the 48th degree of north latitude, he diſcovered Chineſe families, who had migrated from Nankin, and ſettled in that country. The children of theſe people had become perfect Mongous, with their heads ſunk between their ſhoulders, crooked limbs, and a groſs and diſguſting aſpect †. The Japaneſe are ſo ſimilar to the Chineſe, that they may be conſidered as the ſame race of men. Their colour is indeed darker, becauſe they inhabit a more ſouthern climate. They are haughty, warlike, full of vigour, civil, and obliging; but they are a vain and inconſtant people. With incredible patience they ſuſtain hunger, thirſt, cold, heat, and every other hardſhip incident

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* Chardin, tom. 3. p. 86.

† Lettres Edifiantes, Recueil 24.

cident to human nature. Like the Chineſe, they eat their victuals with ſmall ſticks; and they uſe, during their meals, a multitude of ſtrange grimaces and ceremonies. They are laborious and ſkilful artificers; and, in fine, their manners, cuſtoms, and diſpoſitions, are nearly allied to thoſe of the Chineſe.

The ridiculous cuſtom of rendering the feet of their females ſo ſmall that they can with difficulty ſupport their bodies, is common to both nations. Early compreſſion and confinement are ſaid to be the means by which this end is accompliſhed. But it is univerſally allowed, that every woman of faſhion, and every woman who wiſhes to be reckoned handſome, muſt have her feet ſo ſmall that they could eaſily enter the ſhoe of a child of ſix years of age. It may, therefore, upon the whole, be concluded, that the Japaneſe and Chineſe are the ſame race of men; that the commencement of their civilization muſt have been at a very early period; and that they differ more from the Tartars in their manners than in their figure.

The country of Jeſſo, which lies to the north of Japan, is ſituated under a climate which ought to be temperate. It is, however, cold, barren, and mountainous. Its inhabitants are alſo totally different from thoſe of China and Japan. They are a groſs and a brutal race, poſſeſſing neither arts nor manners. Their bodies are thick and ſhort; their hair is long and briſtly; their eyes are black; their forehead is flat; and their colour yellowiſh. Their whole bodies, as well as their faces, are very much covered with hair. They live like ſavages; and their food conſiſts of the blubber and oil of whales, and of other fiſhes. They are exceedingly indolent and ſlovenly. They allow their children to go almoſt naked; and the women employ no other ornament but that of painting their lips and eye-brows

blue.

blue. Hunting bears and rein-deer, and fiſhing whales, conſtitute the chief pleaſure and occupation of the men. Though they have ſome Japaneſe cuſtoms, yet, in general, they have a greater reſemblance to the Samoiedes, or to the northern Tartars, than to the natives of Japan.

In viewing the people on the ſouth and weſt of China, we find, that the Cochin-Chineſe, who inhabit a mountainous region which lies ſouth of China, are more ugly and more tawny than the Chineſe.

The Monarch of Cochin-China is abſolute maſter of that extenſive kingdom, which he governs by the aſſiſtance of four principal miniſters, who poſſeſs the power of diſpoſing of all employments, whether civil or military. The houſehold of the Monarch is compoſed of the ſtrongeſt and moſt handſome men who can be found in the kingdom. He is very rich; and his wealth proceeds from a tax paid by all his ſubjects, from the age of nineteen to that of ſixty. The Cochin-Chineſe, when compared with the other Indians, are a brave, active, and induſtrious people. Though they are poor and ignorant, they are lovers of truth. They are, however, extremely polite to ſtrangers, as well as to each other. The Cochin-Chineſe are fond of women; and a man, by their law, may have as many wives as he can maintain. Women, convicted of infidelity, are expoſed to the fury of irritated elephants. The women have not our ideas of modeſty; for they go quite naked to the middle, and bathe promiſcuouſly, and without any ceremony, in the view of the public. The Cochin-Chineſe, in their perſons, have a great reſemblance to the Chineſe, and their women are fair and beautiful.

In this country, the religion is the ſame with that of China. The people do homage to Pagodas; and their learned mandarines attend the temple of Confucius, in the ſame manner as thoſe of China. The chief learning of the Cochin-Chineſe is their capacity of reading Chineſe books, and acquiring a knowledge of the principles of morality which they contain. The whole country of Cochin-China conſiſts of chains of mountains; and the intervening valleys are well cultivated. The high mountains are covered with wood, and are the habitation of elephants, tygers, and many other ferocious animals. From theſe mountains, however, they procure honey, wax, ratans, gamboge, and even gold. Mines of this precious metal are very frequent; but, though theſe mines might be very productive, if the natives were induſtrious, and acquainted with the art of mining, they are much neglected. They never dig deeper than the height of a man. 'In the place where I ſaw them at work,' ſays the Abbé ROCHEN, 'maſſes of pure gold, perfectly free from 'the mixture of extraneous bodies, and weighing two ounces, are 'ſometimes found. This gold, collected in duſt or ſmall fragments, 'is afterwards formed into cakes, and carried to market, where it is 'ſold like other merchandiſe *.'

The Tonquineſe, who live under a colder climate, and whoſe country is richer, are more beautiful and handſome. We are informed by DAMPIER, that the Tonquineſe are of a middle ſtature; and that, though tawny, their ſkin is ſo fine and delicate, that the ſmall changes in their complexion from redneſs to paleneſs are eaſily perceptible, a circumſtance which diſtinguiſhes them from all the other Indians. The viſage of the Tonquineſe is flat and oval; their noſe

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* Voyage to Madagaſcar, and the Eaſt Indies, by the Abbé Rochon, p. 393. Tranſlat.

noſe and lips well proportioned; their hair long, black, and very thick; and they employ every art to render their teeth black. In the relations ſubjoined to TAVERNIER's voyages, we are told that the Tonquineſe are of a goodly ſtature, and of an olive colour; that they have not the flat faces and noſes of the Chineſe; and that they are, in general, much more handſome.

From the facts above related, it is obvious that theſe nations differ but little from the Chineſe. They reſemble, in colour, the inhabitants of the ſouthern provinces of China. Their being more tawny is owing to the ſuperior heat of their climate; and, though their faces and noſes be more prominent, they may ſtill be conſidered as people who have ſprung from the ſame ſtock. The ſame obſervation is applicable to the natives of Siam, Pegu, Aracan, Laos, &c.; for, though they differ from the Chineſe in colour, yet they differ in a more remarkable manner from the other Indians. According to LOUBERE, the ſtature of the Siameſe is rather ſmall; their bodies are well made; their faces are large, and their cheek-bones prominent; their fore-head contracts ſuddenly, and, like the chin, terminates in a point; their eyes are oblique and ſmall; the white of the eye is yellowiſh; the cheeks are hollow, owing to the great elevation of the upper part of the cheek-bones; the mouth is large, the lips thick, and the teeth black; their complexion is coarſe, being a mixture of brown and red; their noſe is ſhort, and rounded at the point; their ears are naturally large, and are much eſteemed when they are of a remarkable magnitude. All the eaſtern nations diſcover this taſte for long ears. Some draw the lobe of the ear, in order to ſtretch it to a greater length, and pierce it ſo as to allow the admiſſion of an ordinary pendant. Others, as the natives of Laos, ſo prodigiouſly widen the holes in their ears, that a man's hand may be thruſt through them: Hence the ears of theſe people often deſcend to the tops of their ſhoulders.

The ears of the Siameſe are naturally larger than ours. They have coarſe, black, ſtraight hair, which both men and women wear ſo ſhort, that, all round the head, it reaches no lower than their ears. They cover their lips with a perfumed ſpecies of pomatum, which gives them an unnaturally pale appearance. Their beards are ſmall, becauſe they conſtantly pull out the hairs. We are informed by STRUYS, that the women of Siam wear ſuch large and heavy pendants in their ears, that the holes gradually become wide enough to admit a man's thumb. He adds, that the colour of both women and men is tawny; that they are not tall, but handſome; and that, in general, they are a mild and poliſhed people. It is remarked by Father TACHARD, that the Siameſe are very agile, and that their country produces dancers and tumblers equally dexterous as any of thoſe in Europe. He farther tells us, that the cuſtom of blackening their teeth originates from the notion of its being unſeemly for men, like the brutes, to have white teeth.

In the kingdoms of Pegu and Aracan, the inhabitants differ not from thoſe of China and Siam, except in their colour, which is ſomewhat blacker *. Large flat foreheads are admired by the natives of Aracan. To procure this ſpecies of beauty, immediately after birth, they apply a plate of lead to the foreheads of their children. Their noſtrils are large and open; they have ſparkling eyes; and their ears are ſo long, that they reſt upon their ſhoulders. Without reluctance, they eat putrified fiſhes, mice, rats, and ſerpents †. The women

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* Pigafetta, p. 46.

† Voyages de Ovington, tom. 2. 274.

women are pretty fair, and their ears are as long as thoſe of the men [*]. The natives of Achen, who lie ſtill farther north than thoſe of Aracan, have likewiſe flat faces and olive complexions: Their manners are groſs: Their boys are allowed to go quite naked; and the girls have only a thin plate of ſilver to prevent their bluſhes [†]. It is obvious, that all theſe nations differ not much from the Chineſe; and that they reſemble the Tartars in the ſmallneſs of their eyes, their flat viſages, and their olive colour.

In proceeding ſouthward, however, they begin to be much more ſenſibly diverſified. The natives of Malacca, and of the iſland of Sumatra, are ſmall, black, active, and well-proportioned. They go naked from the middle upwards, except a ſmall ſcarf, which they carry ſometimes on one ſhoulder, and ſometimes on the other [‡]. Nature has made them brave; and they become very formidable after taking their opium, which produces in them a kind of ferocious intoxication [||]. According to **Dampier**, the inhabitants of Malacca and Sumatra belong to the ſame race: They ſpeak nearly the ſame language; their tempers are fierce and haughty; their ſtature is of a middle ſize; they have long viſages, black eyes, noſes of a moderate bulk, and thin lips. By the frequent chewing of betle, their teeth are dyed black [§]. In the iſland of Piſſagan, which lies about ſixteen leagues weſt of Sumatra, the inhabitants are tall, and, like the Braſilians, of a yellow colour. They have long ſmooth hair, and go abſolutely naked [**]. Thoſe of the iſlands of Nicobar, which lie north of Sumatra, are of a tawny yellowiſh complexion, and go likewiſe perfectly naked *. We are told by **Dampier**, that the natives of the Nicobar iſlands are tall and handſome; that their viſage is long, their hair ſmooth and black, and their noſes of a moderate ſize; that the women pull the hairs from their eye-brows, &c. In the iſland of Sombrero, to the north of Nicobar, the natives are very black, and paint their faces with various colours †. In Malacca, in Sumatra, and the ſmall adjacent iſlands, though the natives differ between themſelves, they differ ſtill more from the Chineſe, Tartars, &c. and ſeem to have ſprung from a different race; yet the natives of Java, who border upon thoſe of Malacca and Sumatra, have no reſemblance to them; but they reſemble the Chineſe, except in colour, which, like that of the Malays, is red mingled with black. **Pigafetta** remarks ‡, that theſe people likewiſe reſemble the natives of Brazil; that their complexion is coarſe; that, though neither of a remarkably large nor ſmall ſtature, they are very muſcular and ſquat; that their faces are flat, and their cheeks flabby and pendulous; that their eyebrows are large, and inclined toward the temples; that their eyes are ſmall, and their beards thin, and very black. We are informed by Father **Tachard**, that the people of Java are ſtrong and handſome; that they are active and brave; and that the great heat of the climate obliges them to go naked. It appears, from the Lettres Edifiantes, that the inhabitants of Java are of a purpliſh red colour; and that they are mild, courteous, and familiar.

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[*] Recueil des Voyages de la Compagnie Hollandoiſe, tom. 6. p. 251.

[†] Ibid. tom. 4. p. 63. and le Voyage de Mandelſlo, tom. 2. p. 328.

[‡] Les Voyages de Gherardini, p. 46.

[||] Lettres Edifiantes, Recueil, 2. p. 60.

[§] Dampier, tom. 3. p. 156.

[**] Recueil de la Comp. de Holl. tom. 1. p. 281.

It is related by **Francis Legat**, that, in Java, the women, who are not ſo much expoſed to the heat of the ſun, are leſs tawny than

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* Lettres Edifiantes, Recueil, 2. p. 172.

† L'Hiſt. gen. des Voyag. tom. 1. p. 387

‡ Ind. Orient. part 1. p. 51.

than the men; that their countenances are comely, their breaſts prominent and handſome; that their complexion, though duſky, is uniform and beautiful; that they have a delicate hand, a ſoft air, ſparkling eyes, and an agreeable ſmile; and that many of them dance with great ſpirit and elegance [*]. The Dutch voyagers, in general, agree, that the natives of Java are handſome, nervous, and robuſt; that their viſages are flat, their cheeks prominent and broad, their eyes ſmall, and their eye-lids large, their hair long, and their colour tawny; that their beards are ſcanty; that they wear their nails and hair very long; and that they poliſh their teeth with files [†].

From theſe and ſimilar facts, it may be concluded, that the natives of Java have a great reſemblance to the Chineſe and Tartars; and that thoſe of Malacca, Sumatra, and the ſmall iſlands adjacent, differ from them both in form and features. Neither is this phaenomenon ſurpriſing; for it is obvious, that the peninſula of Malacca, the iſlands of Sumatra and Java, as well as the other iſlands in the Indian Archipelago, muſt have received their people originally from the neighbouring nations on the continent. This circumſtance muſt neceſſarily have given riſe to a great variety among the inhabitants, both in colour and features, and in the form of their bodies. For example, in the iſland of Java, there are a people denominated *Chacrelas*, who differ totally from the natives of this iſland, as well as from all the other Indians. They are white and fair, and their eyes are ſo weak, that they cannot bear the rays of the ſun. In the day, they go about with their eyes half ſhut, and directed to the ſurface of the ground; and they ſee beſt during the night [‡].

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[*] Les Voyag. de Franc. Legat. tom. 2. p. 130.

[†] Recueil des Voyag. de la Comp. Holl. tom. 1. p. 392. Mandelſlo, tom. 2. p. 344.

[‡] Les Voyag. de Legat. tom. 2. p. 137.

The inhabitants of the Molucca iſlands, PYRARD remarks, have a great reſemblance to thoſe of Sumatra and Java in language, manners, cuſtoms, arms, colour, &c. *. We are informed by MANDELSLO, that the men are rather black than tawny, and that the women are fairer; that their eyes, eye-brows, and eye-lids, are large; that their bodies are ſtrong and robuſt; that they are agile and dexterous; and that they live long. We are likewiſe told by this traveller, that each iſland has a language † peculiar to itſelf; and that, therefore, they have probably been peopled by different nations. He adds, that the inhabitants of Bali and of Borneo, are rather black than tawny ‡; but, according to other travellers, they are only brown, like the other Indians ‖. It is related by the Dutch travellers, that the natives of the iſland of Banda are remarkable for longevity; that they had ſeen a man aged 130, and many others who approached to that extraordinary period of life; that theſe iſlanders, in general, are very indolent; that the men do nothing but ſaunter about; and that all the laborious offices are performed by the women §.

The inhabitants of Manilla, and of the other Philippine iſlands, by their intercourſe with the Spaniards, the Indians, the Chineſe, the Malabars, the Negroes, &c. are more diverſified, perhaps, than thoſe of any other part of the world. The Negroes, who live in the woods and rocks of Manilla, differ entirely from the other inhabitants. Like the Negroes of Angola, ſome of them have criſped hair,

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* Les Voyag. de Pyrard, tom. 2. p. 178.

† Les Voyages de Mandelſlo, tom. 2. p. 378.

‡ Voyag. de Mandelſlo, tom. 2. p. 363.

‖ Recueil des Voyag. de la Comp. de Holl. tom. 2. p. 120.

§ Ibid. tom. 1. p. 566.

and, in others, it is long, and their colour conſiſts of various ſhades of black. Among theſe people, like the iſlanders mentioned by **PTOLOMY**, ſome have been ſeen, it is ſaid, who had *tails* four or five inches in length. For this ſuppoſed fact, the ingenious **COUNT DE BUFFON** quotes the authority of **GEMELLI CARRERI** *. **BUFFON**, it would appear, had been unacquainted with the hiſtory of **GEMELLI CARRERI**. He was an Italian, and for many years was tortured with the gout. This valetudinarian took a fancy into his head, that, for his own amuſement, he would write ſuppoſititious travels; and, from the aid of books and his own imagination, he compoſed a moſt voluminous work. He writes in the firſt perſon, which induces an unwary reader to believe that **CARRERI** actually viſited all the people and countries he deſcribes. But the fact is well known, that his imaginary travels were compoſed when ſitting in his elbow chair, with his feet wrapped in flannel. **STRUYS** is likewiſe quoted as an authority for the exiſtence of tailed-men; but he gives them a more reſpectable tail; for he makes it more than a foot long †: He adds, that this tail was covered with red hair, and was ſomewhat ſimilar to that of an ox. This tailed man, he farther aſſerts, aſſured him, that the tail was a reſult of the climate; for all the natives of the ſouthern part of the iſland had tails. **LINNAEUS**, and ſome other authors of learning and reſpectability, have given credit to theſe and ſimilar relations.

We are told by **DAMPIER**, that, in the iſland of Mindanao, one of the principal and moſt ſoutherly of the Philippines, the inhabitants are of a middle ſtature; that their limbs are ſlender, their bodies thin and ſtraight, their viſages oval, their foreheads flat, their eyes ſmall and black, their noſes ſhort, their mouths large, their lips red and thin, their teeth and hair black, their colour tawny and more yellow than ſome of the other Indian tribes; that the women are handſome and fairer than the men; that their viſages are longer, and their features pretty regular, except the noſe, which is flat and ſhort; that their limbs are ſlender, and their hair long and black; and that, in general, the men are alert and ingenious, but much addicted to robbery and idleneſs. From the Lettres Edifiantes, we learn, that the natives of the Philippine iſlands have a reſemblance to the Malays, who formerly conquered theſe iſlands; that the noſe is ſhort, the eyes large, the complexion is of a yellowiſh olive colour, and their language and cuſtoms are nearly the ſame.

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* Tom. 5. p. 68.

† Voyag. de Struys, tom. 1. p. 100.

The iſland of Formoſa lies to the north of Manilla, and is not far diſtant from the province of Fokien in China. Theſe iſlanders, however, have no reſemblance to the Chineſe. STRUYS tells us, that the men of this iſland, particularly thoſe who live in the mountains, are ſmall in ſtature; that their faces are flat; that the women have full coarſe breaſts, and a beard like the men; that their ears are naturally long, and their length is augmented by heavy ſhells which they uſe as pendants; that their hair is long and black, and their complexion of a blackiſh yellow colour; and that, though inclined to indolence, they are dexterous in managing the bow and the javelin, excellent ſwimmers, and run with incredible ſwiftneſs. With regard to a very extraordinary cuſtom which takes place in this iſland, all travellers are agreed; namely, that the women are not allowed to bring forth children till after the age of thirty-five, though they are permitted to marry long before that period. RECHTEREN, ſpeaking of this ſtrange cuſtom, expreſſes himſelf in the following manner: ‘After marriage, the women are not allowed to be mothers till they

‘ have completed their thirty-fifth or thirty-ſeventh year. When ‘ they are pregnant before this period, their prieſteſſes trample with ‘ their feet upon the women’s bellies, and in this manner force them ‘ to miſcarry; an operation much more painful and dangerous than ‘ a natural labour. But it is diſgraceful, and even a high crime, to ‘ allow a child to come into the world before the age preſcribed. ‘ I have ſeen women who had ſixteen of theſe forced miſcarriages, ‘ and were only permitted to bring forth their ſeventeenth child *.’

The Ladrone or Mariana iſlands are fartheſt removed from the eaſtern coaſt; they are inhabited by a people rude and unpoliſhed. Till the arrival of the Europeans, Father GOBIEN relates, they had never ſeen artificial fires; and that they were greatly aſtoniſhed when MAGELLAN exhibited to them the wonderful effects of this ſubtile but active element. Their colour is tawny, though rather more fair than that of the natives of the Philippian iſlands; they are a more robuſt race of people than the Europeans; and they are tall and well-proportioned. Though they feed almoſt ſolely on roots, fruits, and fiſhes, they are fat and corpulent; but their corpulency prevents them not from being nimble and active. Their longevity is ſo great, that the age of an hundred years is not eſteemed to be extraordinary among theſe people, without experiencing either diſeaſe or ſickneſs. In general, the hair of theſe iſlanders is criſped †, their noſe and eyes are large, and their complexion is ſimilar to that of the Indians. The natives of Guan, one of theſe iſlands, have long black hair, a large noſe, white teeth, thick lips, a long viſage, and a ferocious aſpect.

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* Les Voyag. de Rechteren dans le Recueil des Voyag. de la Comp. de Holl. tom. 5. p. 96.

† L’Hiſt. des Iſles Marianes, par le P. Gobien.

aſpect. They are alſo very robuſt; and their height, it is ſaid, is often ſeven feet [*].

The land of the Papous and New Guinea lie to the ſouth of the Mariana iſlands, and to the eaſt of the Moluccas. We are told by ARGENSOLA, that the Papous are as black as the Caffres; that their hair is criſped; and that their faces are meagre, and have a diſagreeable aſpect. Some of theſe people, however, are as fair as the Germans; but they have weak eyes [†]. LE MAIRE informs us, that the natives of this country are very black, ſavage, and brutal. They wear rings in their ears and noſes, bracelets of mother of pearl on the wriſts and above the elbows, and cover their heads with bonnets made of the barks of trees, and painted with various colours. They are a robuſt and well proportioned people. In the chace they are exceedingly ſwift; and, as they know not the uſe of iron, clubs, lances, and ſpears made of hard wood, are their only weapons. Like dogs, they employ their teeth as offenſive weapons. The appearance of the women is diſguſtful to Europeans. They have breaſts ſo long that they hang down to the navel, and very prominent bellies. Their limbs and arms are ſmall; their viſages reſemble thoſe of apes; and their features are truly hideous [‡]. DAMPIER farther tells, that the inhabitants of the iſland of Sabala, in New Guinea, are a ſpecies of tawny Indians, with long black hair, and whoſe manners differ not from thoſe of the other eaſtern iſles; and that, beſide theſe, who ſeem to be the chief inhabitants of New Guinea, there are likewiſe Negroes with woolly criſped hair [||].

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[*] Dampier, tom. 1. p. 378.; and Cowley's Voyage round the World.

[†] L'Hiſt. de la Conquête des iſles Moluques, tom. 1. p. 148.

[‡] Les Voyag. de la Comp. de Holl. tom. 4. p. 648.; and La Navigation Auſtrale de Jacques le Maire.

[||] Dampier, tom. 5. p. 82.

When mentioning another of theſe iſlands, called *Garret-Denys*, **Dampier** remarks, that the natives are robuſt, black, and well formed; that they have large roundiſh heads, and ſhort criſped hair, which they cut in different faſhions, and paint with various colours; that they have large round faces, and flat broad noſes; that, however, their countenances would not be ſo diſguſting, if they did not thruſt through their noſtrils a peg about an inch thick, and four inches long, each end of which reſts upon their cheek-bones, and a ſmall part of the noſe only appears around this abſurd ornament; and that in their ears ſimilar pegs are worn *.

On the coaſt of New Holland, which is ſituated in the 16th degree of ſouth latitude, the natives are perhaps the moſt miſerable of the human ſpecies, and make it approach neareſt to the condition of brutes. They are erect, meagre, and tall. They have thick eye-brows, a round fore-head, and very large heads. Their eye-lids are perpetually half ſhut, a habit contracted in infancy to defend their eyes from the aſſaults of the gnats; and, as they ſeldom open their eyes, they cannot ſee objects at a diſtance by any other means than by elevating their heads, as if they were looking at ſomething far above their own height. Their noſes and lips are thick, and their mouths are large. It ſhould appear that they pull out the two fore-teeth of the upper-jaw; for in neither ſex, nor at any particular period of life, are theſe teeth to be ſeen. They are beardleſs; their viſage is long, without exhibiting a ſingle agreeable feature; their hair is black, ſhort, and criſped; and their ſkin is equally black as that of the Guinea Negroes. Their only clothing conſiſts of a piece of the bark of a tree tied round their waiſt, with a handful of long herbs placed in the middle. They erect no houſes; and, without

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* Dampier, p. 102.

out any covering, they ſleep on the ground. Men, women, and children, aſſociate promiſcuouſly, to the number of twenty or thirty. A ſmall fiſh, which they catch in reſervoirs made with ſtones in arms of the ſea, conſtitutes their chief nouriſhment; and with bread, and every ſpecies of grain, they are totally unacquainted *. In another part of the coaſt of New Holland, about the twenty-ſecond or twenty-third degree of ſouth latitude, the natives appear to be of the ſame race with thoſe now deſcribed. They have the ſame defect in their eyes, and are ugly and diſguſting. Their bodies are tall and ſlender; their ſkin is black, and their hair criſped †.

In a voyage to Botany Bay, in New South Wales, Governour Phillip, commander of a ſquadron fitted out to eſtabliſh a ſettlement for Britiſh felons in that remote region, informs us, that the natives, though in ſo rude and uncivilized a ſtate as not to have hitherto made the ſmalleſt attempt to defend themſelves by clothes from the inclemency of the weather, have ſome ideas of ſculpture. In all the excurſions of Governour PHILLIP in this iſland, or rather immenſe continent, the repreſentations of animals, of ſhields, of weapons of war, and even of men, were ſeen carved upon the rocks. Theſe figures were rough, but completely expreſſed the objects they were intended to repreſent. The figures of fiſhes were frequent; and, in one place, the form of a large lizard was ſketched out with conſiderable accuracy. On the top of a hill, the figure of a man, in the attitude commonly aſſumed by theſe people when they begin to dance, was executed in a ſtill ſuperior manner. The bodies of theſe people, in general, ſmell ſtrongly of oil; and their dark colour is greatly augmented by dirt. They diſcover, however, emotions of diſguſt when they meet with effluvia to which their organs have not been accuſtomed.

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* Dampier, tom. 2. p. 171.

† Ibid. tom. 4. p. 134.

tomed. Bread and meat they never refuſe, but generally throw them away ſoon after. But every preſent of fiſh they always accept with avidity. Obſerving the ground to be raiſed in ſeveral places, like a kind of rude graves, Governour PHILLIP had ſome of them opened. In one, a jaw-bone was found not fully conſumed; but, in general, they contained aſhes only. From the poſition of theſe aſhes, it appeared that the body muſt have been laid horizontally, and raiſed from the ground a few inches, or as high as to admit a fire underneath.

Before drawing any general concluſions from all theſe facts and deſcriptions, we ſhall take a curſory view of ſome of the Aſiatic and African nations.

In traits and features, the Moguls, and other natives of the peninſula of India, nearly reſemble the Europeans, except ſome ſlight differences in colour. Though, in the Indian language, *Mogul* ſignifies *white*, the ſkin of the Moguls is olive. The Mogul women are very handſome, and bathe often. They are, like the men, of an olive colour; and, contrary to the common run of European women, their legs and thighs are long, and their bodies ſhort*. We are told by TAVERNIER, that, after paſſing Lahor, and the kingdom of Caſhmire, the Mogul women have no hair on any part of their bodies, and that the men have very ſcanty beards †. The Mogul women, ſays THEVENOT, are chaſte, and very fruitful. They bring forth their children with ſo much eaſe, that they not unfrequently walk the ſtreets the day after they have been delivered. In the kingdom of Decan, he adds, that the men marry at ten, and the women at eight years of age; and that they frequently have children at this early period of life. But women who have born children ſo ſoon, generally ceaſe to bear after they ſee their thirtieth year, when they become wrinkled, and have all the appearances of old age. Some of theſe women puncture their ſkins in imitation of flowers, and paint them with the juices of plants, which makes the ſkin ſeem to be ſtuffed with flowers *.

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* Les Voyages de la Boulaye le Gouz, p. 153.

† Voyages de Tavernier, tom. 3. p. 80.

In Bengal, the natives are more yellow than the Moguls; and their manners are likewiſe very different. The women of Bengal, inſtead of being chaſte, are thought to be the moſt laſcivious and debauched in all India. In this country, a great ſlave-trade, both of males and females, is carried on; and many eunuchs are made, both by a ſimple privation of the teſtes, and by a total amputation of the parts. The natives of Bengal are beautiful and handſome; they are fond of commerce; and, in their manners, they are exceedingly mild †.

On the Coromandel coaſt, the natives are blacker than thoſe of Bengal; they are alſo leſs civiliſed, and go almoſt naked. On the Malabar coaſt, the natives are ſtill more black. They are of the ſame ſize with the Europeans, and have long, ſmooth, black hair. The women wear gold rings in their noſes; and men, women, and girls, bathe promiſcuouſly in ponds made in the middle of their towns. Though black, or at leaſt exceedingly brown, the women are comely and handſome; and they are often married at the age of eight years ‡.

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* Tavernier, tom. 3. p. 34.

† Voyages de Pyrard, p. 34.

‡ Recueil des Voyages, tom. 6. p. 461.

Among the different nations of India, we meet with very ſingular, and often whimſical cuſtoms. The Banians refuſe to eat any thing that has been animated. They are afraid to kill the ſmalleſt inſect, and will not deſtroy the louſe that bites them. To feed the birds, fiſhes, and inſects, they throw rice and other grains upon the ground and into the rivers When they accidentally meet a fiſher or hunter, they earneſtly intreat him to deſiſt from his employment. If he ſtill perſiſts, they offer him money for his gun or his net; and, if he does not comply, to frighten the fiſhes, they trouble the waters; and to put the birds and other game to flight, they raiſe the moſt hideous cries *.

In Calicut, there is a band of nobles, called *Naires*, whoſe ſole profeſſion is that of arms. Though of an olive colour, they are handſome and comely. They are hardy, tall, brave, and very dexterous in the management of their weapons. They lengthen their ears to ſuch a degree, that they hang down to their ſhoulders, and ſometimes even lower. Theſe Naires are allowed to have only one wife; but the women may have as many huſbands as they chuſe. Father TACHARD informs us, that, in the claſs or caſt of Nobles, a woman has ſometimes ten huſbands, whom they conſider as ſlaves ſubjected to their beauty. This privilege is confined to ladies of rank; for women of inferior ſtations are allowed but one huſband. Women of this condition, however, take care to alleviate this ſeeming hardſhip by their intercourſe with ſtrangers, to whoſe embraces they abandon themſelves without reſerve, and their huſbands preſume not to challenge them. The daughters are proſtituted by their mothers even before they arrive at a proper age. The common people of Calicut are ſmaller, worſe ſhaped, and more ugly than the

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* Voyages de Struys, tom. 2. p. 225.

Naires or nobles [*]. Among the latter, ſome men, as well as women, have legs as thick as the body of an ordinary perſon. This deformity is not a conſequence of any accident; for they have it from their birth. The ſkin of theſe legs is rough and hard like a wart. Notwithſtanding this cumberſome deformity, the perſons ſubjected to it are both active and nimble. This thick-legged race have not multiplied greatly either among the Naires or the other Indians. They appear, however, in other places, and particularly in the iſland of Ceylon [†].

Though not equally black, the natives of Ceylon reſemble thoſe of the Malabar coaſt [‡]. Their ears hang down to their ſhoulders; their aſpect is mild; and they are an alert, dexterous, and vivacious people. The ordinary inhabitants go almoſt naked; and the women, according to a pretty general cuſtom in India, have their boſoms always uncovered [‖]. In the northern part of the iſland of Ceylon, we meet with a ſpecies of ſavages called *Bedas*, who occupy a ſmall diſtrict only. The ſpot they inhabit is covered entirely with wood. Here they conceal themſelves in ſuch a manner, that to diſcover any of them is extremely difficult. Their complexion, like that of the Europeans, is fair, and ſometimes red. Their language ſeems to have no analogy with that of any other peculiar to India. They have neither villages nor houſes; and with the reſt of mankind they have no intercourſe. Bows and arrows are their only arms, with which they kill wild boars, ſtags, and other animals. They do not dreſs their meat, but ſeaſon it with honey.

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[*] Pyrard, p. 411.

[†] Ibid. p. 416. Recueil des Voyages de la Comp. de Holl. tom. 4. p. 362.

[‡] Pigafettae Ind. Orient. part 1. p. 39.

[‖] Recueil des Voyages, &c. tom. 7. p. 19.

We are ignorant of the origin of this tribe, who live in detached families, and are not numerous *. But theſe Bedas of Ceylon, and the Chacrelas of Java, who are both fair and few in number, ſeem, by ſome accidental cauſe, ſuch as ſhipwreck, to be of European extraction.

The natives of the Maldiva iſlands are handſome, and, if we except their olive colour, they differ little from the inhabitants of Europe. They are, indeed, a mixed people, being compoſed of almoſt all nations. Thoſe who occupy the northern parts of theſe iſlands are more civilized than thoſe who inhabit the more ſouthern diſtricts. Notwithſtanding their olive colour, the women are beautiful. Their hair is univerſally black, which they regard as a beautiful ornament. To have their hair very long and thick, is eſteemed to be highly ornamental; and, to accompliſh this purpoſe, they anoint their heads with a perfumed oil. The men are more hairy than thoſe of Europe. Theſe iſlanders love exerciſe, are induſtrious artiſts, very ſuperſtitious, and much addicted to venery †.

The inhabitants of Cambaia, in general, are aſh-coloured; but thoſe who live near the ſea are more ſwarthy than the others ‡. The natives of Guzarat are yellow ‖; and thoſe of Goa, and of the neighbouring iſlands, are olive §. The Dutch voyagers inform us, that the natives of Guzarat are yellowiſh; that their ſize is nearly the ſame with that of the Europeans; that their women, who are ſeldom expoſed

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* L'Hiſt. de Ceylon, par Ribeyro, p. 177.

† Pyrard, p. 120. and 324.

‡ Pigafettae Ind. Orient. part 1. p. 34.

‖ Voyages de la Boulaye le Gouz, p. 225.

§ Id. ibid.

expoſed to the ſun, are more fair than the men, and that ſome are almoſt as white as the Portugueſe *. We are told by **MANDELSLO**, that the people of Guzarat are more or leſs tawny, or olive, according to the climate under which they live; that the men are well made and ſtrong, and that their faces are large, and their eyes black; that the women are ſmall, but handſome; that they have long hair, wear pegs in their noſes, and large pendants in their ears †. The antient inhabitants of Guzarat may be eaſily diſtinguiſhed from the more modern by their colour, which is much blacker; and they are alſo more barbarous and ſtupid ‡.

The principal ſettlement of the Portugueſe in India is Goa; and, though its former ſplendour be greatly decayed, it ſtill continues to be an opulent and a commercial city. It was once the greateſt market for ſlaves in the whole known world. Here beautiful women and girls were ſold from every nation of Aſia. Theſe female ſlaves, who were of all colours, had many accompliſhments: They were ſkilled in muſic, and in every kind of ſewing and embroidery. The Caffre girls from Moſambigue, though black, were the chief favourites of the Indians. ‘ It is remarkable,’ ſays **PYRARD**, ‘ that ‘ the ſweat of the Indians, whether male or female, has no unſavoury ‘ odor, while the ſtench of the African Negroes, when they are over‘ heated, is perfectly unſupportable.’ He adds, that the Indian women love the European men, and prefer them even to the white Indians ‖. The Perſians lie adjacent to the Moguls, whom they greatly reſemble: Thoſe of them, eſpecially, who occupy the ſouthern parts of Perſia, differ very little from the Indians. The natives of

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* Recueil des Voyages, &c. tom. 6. p. 405.

† Mandelſlo, p. 195.

‡ Ibid. tom. 2. p. 222.

‖ Pyrard, tom. 2. p. 64.

Ormus, of Baſcia, and of Balaſcia, are very brown and tawny; while thoſe of Cheſmur, and other provinces of Perſia, where the heat is not ſo intenſe as at Ormus, are fairer; and thoſe of the northern provinces are ſtill more white [*]. According to the Dutch voyagers, the women in the iſlands of the Gulph of Perſia are brown and yellow, and by no means beautiful. Their viſages are large, and their eyes ugly. They reſemble the Indian women in ſome of their manners and practices, as that of wearing rings in the cartilages of their noſes, and of paſſing a gold pin through the ſkin of the noſe, near the eyes [†]. This cuſtom of piercing the noſe, and ornamenting it with rings and other trinkets, extends much farther than the Gulph of Perſia; for many of the Arabian women wear rings in their noſes; and the men, by way of gallantry, often ſalute their wives through theſe rings, which are ſometimes large enough to encircle the whole mouth [‡].

We are told by XENOPHON, that the Perſians, in general, were a thick and a fat people. MARCELLINUS, on the contrary, ſays, that, in his time, they were meagre and thin. With this laſt author OLEARIUS agrees, and adds, that they are ſtrong and hardy; that their colour is olive; and that their hair is black, and their noſes aquiline [‖]. CHARDIN informs us, that the blood of the Perſians is naturally groſs; for the Guebres, a remnant of the antient Perſians, are ugly, ill-made, and rough ſkinned. The inhabitants of the provinces which border upon India, becauſe they never intermix with other tribes, are almoſt equally clumſy and deformed as the Guebres. In other parts of the kingdom, however, the blood of the Perſians is now highly refined by frequent alliances with the Circaſſians and Georgians, two nations who, in perſonal beauty, ſurpaſs all the world. In Perſia, there are few men of rank who have not been produced by Circaſſian or Georgian mothers. Even the King himſelf, on the female ſide, is generally ſprung from one or other of theſe nations. As it is many ages ſince this mixture commenced, the Perſian women have become, though they do not rival the ladies of Georgia, extremely beautiful and handſome. The men are, in general, erect and tall; their complexion is ruddy and vigorous, and they have an engaging deportment and a graceful air. The mildneſs of the climate, joined to their temperate mode of living, contribute greatly to improve the beauty of their perſons. This quality they do not inherit from their fathers; for, without the aid of commixture with fine women from other countries, the Perſian men of rank, who are deſcendants of the Tartars, would be very deformed and ugly. But now the Perſians are a refined and an ingenious people. Their imagination is extremely fertile. Though warlike, they are very fond of the arts and ſciences. Their tempers are ſoft and ductile, and they are vain and ambitious of praiſe. They are exceedingly voluptuous, and much addicted to gallantry. They are prodigal and luxurious; and, to commerce and oeconomy, they are equally ſtrangers [*].

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[*] La Deſcription des Provinces Orientales par Marc Paul, p. 22, 39. Pyrard, tom. 2. p. 256.

[†] Recueil des Voyages de la Comp. de Holl. tom. 5. p. 191.

[‡] Voyage fait par ordre du Roi dans la Paleſtine, par M. D. L. R. p. 260.

[‖] Voyage d'Olearius, tom. 1. p. 501.

In Perſia, fine women, of all complexions, are common. On account of their beauty, they are imported thither by the merchants from every country. The white women are brought from Poland, Ruſſia, Circaſſia, Georgia, and the frontiers of Great Tartary. The tawny

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[*] Chardin, tom. 2. p. 34.

females are tranſported from the dominions of the Mogul, and from the kingdoms of Viſapore and Golconda, and the blacks from Melinda and the coaſts of the Red Sea [*]. The inhabitants of Perſia, Turkey, Arabia, Egypt, and of Barbary, in the time of Mahomet and his ſucceſſors, extended their dominions by invading immenſe territories, and, by intermixing with the natives of all theſe regions, became exceedingly diverſified both in manners and appearance. The Turks, the Perſians, and the Moors, have acquired a conſiderable degree of civilization and poliſhed manners. But the Arabs, in general, ſtill continue in a ſtate of rudeneſs, and of lawleſs independency. Like the Tartars, the Arabs roam about from place to place, without any government or law, and almoſt without any ſocial intercourſe. Their chiefs authoriſe rape, theſt, and robbery. They have no eſtimation for virtue, and glory in almoſt every ſpecies of vice. Though inured to labour, the Arabs live in extreme miſery. They have neither bread nor wine; neither do they cultivate the ground. Inſtead of bread, they uſe ſome wild grain, which they mix with the milk of their cattle [†]. They keep flocks of ſheep, goats, and camels, which they lead from place to place till they meet with a ſufficient paſture. Here they erect their tents, and live with their families till the graſs is conſumed, when they decamp, and go in queſt of another fertile ſtation [‡]. Though their mode of living be uncomfortable, and their food very ſimple, the Arabs are a robuſt and a ſtrong people: Their ſtature is not diminutive, and they are, in geral, pretty handſome. But as moſt of them go either entirely naked, or ſlightly covered with a tattered ſhirt, their ſkins are ſcorched with the heat of the ſun [‖].

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[*] Tavernier, tom. 2. p. 368.

[†] Les Voyages de Villamon, p. 603.

[‡] Thevenot, tom. 1. p. 330.

[‖] Voyages de Villamon, p. 604.

Thoſe who inhabit the coaſts of Arabia Felix, and the iſland of Socotora, are of a ſmaller ſtature, and their complexions are aſh-coloured or tawny. The Arabs paint their lips, arms, and the moſt conſpicuous parts of their bodies, with a deep blue colour *. This paint, which they lay on in little dots, and make it penetrate the fleſh by puncturing the ſkin with needles, can never be effaced †. This cuſtom is alſo frequent among the Negroes who carry on trade with the Mahometans. The Arabian girls who live on the frontiers of Tunis and Tremeſen, to improve their beauty, paint their bodies with cyphers of a blue colour. This effect they produce by means of vitriol and the point of a lancet. In this practice they are followed by the country Africans, but not by thoſe who live in towns. Some of theſe, indeed, paint a ſmall flower on the fore-head, their cheek, or their chin, with the ſmoke of galls and ſaffron, which produces a fine black. They likewiſe blacken their eye-brows ‡. The Arabian women of the Deſert, La Boulaye informs us, paint their hands, lips, and chin, of a blue colour; that, in general, they wear rings of gold or of ſilver, about three inches diameter, in their noſes; that, though born fair, their complexions are injured by a continual expoſure to the ſun; and that the young girls are very agreeable, and ſing almoſt perpetually ‖.

‘ The Arabian princeſſes and ladies,’ another traveller tells us, ‘ whom I was permitted to ſee, were extremely handſome, beautiful, ‘ and fair, becauſe they are always covered from the rays of the ‘ ſun. But the common women, beſide their tawny complexions, ‘ are

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* Pigafettae Ind. Orient. part 1. p. 25.

† Voyages de Pietro della Valle, tom. 2. p. 269.

‡ L'Afrique de Marmol, tom. 1 p. 88.

‖ Voyages de la Boulaye le Gouz, p. 318.

‘ are very much blackened by the ſun; their form is exceedingly ‘ diſagreeable; and, except thoſe natural attractions which always ‘ accompany youth, I could never perceive any thing in their appearance that could pleaſe the fancy. Theſe women puncture ‘ their lips with a kind of needles, and cover them with gun-powder ‘ and the gall of oxes, which penetrate the ſkin, and render them blue ‘ and livid during life. They employ the ſame art on the angles of ‘ the mouth, on each ſide of the chin, and upon the cheeks. They ‘ paint the eye-lids with a black powder, and draw a black line from ‘ the corner of each eye, with a view to make them appear more ‘ expanded; for the chief beauty of the eaſtern women conſiſts in ‘ large and prominent eyes. Among the Arabs, female beauty is ‘ expreſſed by ſaying that ſhe has the eyes of the antelope. They ‘ always compare their miſtreſſes to this ſprightly animal; and black ‘ eyes, and the eyes of the antelope, are the principal topics of their ‘ love-ſongs. The antelope is indeed a moſt beautiful, and a handſome creature. In its aſpect it has a degree of innocent timidity, ‘ which has a great reſemblance to the modeſty and apprehenſion ‘ natural to young women. They puncture their arms and hands, ‘ and form upon them the figures of animals, &c. and paint their ‘ nails of a reddiſh colour. With the ſame colour, the men likewiſe ‘ paint their hair and the tails of their horſes. The women pierce ‘ their ears in ſeveral places, to which they hang rings and broaches. ‘ They alſo wear bracelets on their arms and legs *.’ To this account it may be added, that the Arabs are very jealous of their wives; and that, though they either purchaſe them, or carry them off by force, they treat them with gentleneſs and reſpect.

Though adjacent to the Arabs, and though governed by ſimilar laws,

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* Le Voyage fait par ordre du Roi dans la Paleſtine, par M. D. L. R. p. 260.

laws, the Egyptians have very different manners and cuſtoms. For example, in all the towns and villages along the Nile, there are young girls deſtined by the public for the pleaſure of travellers, without any obligation to pay for the indulgence. For this ſtrange ſpecies of hoſpitality they have houſes filled with theſe girls; and with rich men, when about to die, it is reckoned a pious deed to found and endow houſes for this charitable purpoſe. The Egyptian women are very brown, but have fine lively eyes. They are pretty tall; their dreſs is not agreeable; and, in their converſation, they are exceedingly tireſome *. They are ſaid to be very prolific †. Notwithſtanding the many ſalubrious qualities aſcribed to the periodical overflowings of the Nile, GRANGER tells us, that the air of Egypt is unfavourable to health; that diſeaſes of the eyes are very frequent, and ſo difficult to cure, that the patients generally loſe their ſight; that there are more blind perſons in Egypt than in any other country; and that, during the overflowings of the Nile, the greateſt part of the inhabitants are tormented with obſtinate and deleterious dyſenteries ‡.

The Egyptians of both ſexes are generally of an olive colour; and, the higher we aſcend from Cairo, the people become more tawny, till we arrive at the confines of Nubia, where they are nearly as black as the Nubians themſelves. The principal vices of the Egyptians are idleneſs and cowardice. During the day, their chief employment is drinking coffee, ſmoaking tobacco, ſleeping, and chattering in the ſtreets. Though groſsly ignorant, they are fantaſtically vain, affect to deſpiſe all other nations, and are much offended when any

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* Les Voyages du P. Vanſleb. p. 43.

† Les Voyages du Sieur Lucas, p. 83.

‡ Ibid. tom. 3. p. 194.; and P. Vanſleb. p. 42.

any perſon adviſes them to ſend their children to Europe for inſtruction in the arts and ſciences *.

The nations on the coaſts of the Mediterranean Sea, from Egypt to the Weſtern Ocean, and thoſe who inhabit the internal regions of Barbary, as far as Mount Atlas, conſiſt of various races, as thoſe of the original natives, Arabs, Vandals, and Spaniards. In more ancient times, the Romans and Egyptians peopled theſe territories with men of very different qualities. For example, the inhabitants of the mountains of Arras have no reſemblance in their aſpect and complexion to the adjacent tribes. Inſtead of being tawny, their complexion is white and ruddy; and their hair is of a deep yellow; but that of the neighbouring nations is black. From theſe and ſimilar circumſtances, Dr SHAW thinks it probable that they are deſcendents of the Vandals, who, after their expulſion, took refuge in parts of theſe mountains †. In the kingdom of Tripoli, the women, though adjacent to thoſe of Egypt, have not the ſmalleſt reſemblance to them. The former are tall, and conſider height of ſtature as an eſſential characteriſtic of beauty.

It is an affectation among the Mooriſh women to have their hair ſo long as to reach to their heels; and thoſe whoſe hair is ſhorter, uſe falſe locks ornamented with ribbons. They paint the hair of their eye-lids with black lead, and conſider the dark colour produced by it as a great mark of beauty. This cuſtom is both general and very ancient: It was practiſed by the ladies of Greece and of Rome, as well as by thoſe of the Eaſt ‡. Even in Europe, the Mooriſh women would be reckoned handſome. The ſkin of their children is

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* Lucas, tom. 3. p. 194.; and P. Vanſleb. p. 42.

† Shaw's Travels. ‡ Ibid.

is very fair and delicate; and though, by expoſure to the ſun, the boys ſoon become ſwarthy; yet the girls, by keeping more within doors, preſerve their beauty till the age of thirty, when they generally ceaſe to bear children. As a recompenſe for this early ſterility, they are often mothers at the age of eleven, and grandmothers at that of twenty-two; and, as they live as long as the Europeans, they commonly ſee ſeveral generations *. From MARMOL's deſcription of theſe different countries, it appears, that, in Barbary, the inhabitants of the mountains are white, and that thoſe of the plains and ſea-coaſts are brown and tawny †. With regard to the Numidians, he informs us, that they are rather tawny than black; that, though the men be meagre, the women are pretty fair and jolly ‡; but that the natives of Guaden, at the extremity of Numidia, and on the frontiers of Senegal, are rather black than tawny ‖; that, on the contrary, the women of the province of Dara are freſh-coloured and beautiful §.

From the above hiſtorical enumeration, it appears, that all the people who live between the 20th and 35th degree of north latitude, that is, from the Mogul empire to Barbary, and even from the Ganges to the weſtern coaſt of Morocco, differ not much from each other, except in ſuch varieties as have ariſen from intermixtures with more northern nations, who have occaſionally conquered and over-run ſome of thoſe vaſt regions. In this extenſive territory, which ſtretches, nearly within the ſame parallels, about two thouſand leagues, the people are brown or tawny, but pretty handſome and comely. If, in the next place, we ſcrutinize thoſe who live under more temperate climates, we ſhall find, that the inhabitants of the northern

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* Shaw's Travels.

† Marmol, tom. 2. p. 536.

‡ Ibid. tom. 3. p. 6.

‖ Ibid. p. 7.

§ Ibid. p. 11.

northern parts of the Perſian and Mogul empires, the Armenians, the Turks, the Mingrelians, the Georgians, the Circaſſians, the Greeks, and the Europeans in general, are not only the faireſt, but the moſt handſome people on this globe; and that, however remote Caſhmire may be from Spain, or Circaſſia from France, the natives of thoſe countries, who are nearly at equal diſtances from the equator, have a great reſemblance to each other. **Bernier** remarks, that the people of Caſhmire are famous for their beauty. They are equally handſome as the Europeans, and have not a feature peculiar to the Tartarian race. Their women are beautiful; and it is a common practice with ſtrangers, when they viſit the Mogul court, to marry Caſhmirian women, in order to procure children by them as fair as genuine Moguls *.

The blood of Georgia is ſtill more refined than that of Caſhmire. In the former country, an ugly countenance is hardly to be ſeen. With regard to the Georgian women, Nature has adorned them with a profuſion of graces. They are ſlender-waiſted, tall, handſome, and their faces are extremely beautiful †. The men are alſo very handſome ‡. Nature has made them ingenious; and, if neglect of proper education, joined to debauched manners, did not render them very ignorant, they might make a conſiderable progreſs in the arts and ſciences. But there is not a country, perhaps, in the univerſe, where libertiniſm and drunkenneſs have arrived at a degree ſo diſgraceful as in Georgia. We are told by **Chardin**, that even the clergy are much addicted to wine; and that they keep a number of female ſlaves, whom they uſe as concubines. That he was informed, he adds, by the prefect of the Capuchins, that the Patriarch of Georgia openly declares, that the man who does not intoxicate himſelf at their great feſtivals, as thoſe of Chriſtmas and Eaſter, is unworthy of the name of a Chriſtian, and deſerves to be excommunicated from the church *. However, notwithſtanding all theſe vices, the Georgians are a civil, grave, humane, and peaceable people.

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* Voyage de Bernier, tom. 2. p. 281.

† Chardin, p. 204.

‡ Il Genio vagante del Conte Aurelio degli Anzi, tom. 1. p. 170.

It is remarked by STRUYS, that the women of Circaſſia are alſo exceedingly fair and beautiful. Their complexion exhibits the moſt delicate tints. Their fore-heads are ſmooth and large. Without the aſſiſtance of art, their eye-brows are ſo fine, that they have the appearance of curved threads of ſilk. Their eyes are large, alluring, and full of animation. Their noſes are handſome, and their lips are vermilion itſelf. Their mouths are ſmall, but the perpetual reſidence of ſmiles. Their chins are the termination of the moſt perfect oval. Their throat and neck are extremely handſome; and their ſkin is as white as ſnow. Their hair is of a beautiful black colour. Their ſtature is tall, and their movements graceful. They wear a ſmall black cap, upon which they faſten a roller of the ſame colour. But the widows, inſtead of this roller, wear the bladder of an ox fully blown up with air, which gives them a ludicrous appearance. The women of inferior ſtation, in ſummer, wear a ſhift only, which is commonly blue, red, or yellow, and open to the middle of the body †.

We are informed by TAVERNIER, that the women of Circaſſia and Comania, like thoſe of Georgia, are extremely handſome; that

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* Chardin, p. 205.

† Struys, tom. 2. p. 75.

they preſerve the freſhneſs of their complexions till the age of forty-five or fifty; and that they are all induſtrious, and frequently employed in the moſt laborious offices. Some of their laws with regard to marriage are ſingular. If a huſband is diſpleaſed with his wife, and makes the firſt complaint, the ſuperintendant of the diſtrict ſends for the wife, ſells her, and procures another for the huſband. The ſame privilege is enjoyed by the wife if ſhe makes the firſt complaint *.

According to the relations of travellers, the Mingrelians are equally handſome and beautiful as the Circaſſians or Georgians, and ſeem to belong to the ſame race of people. 'In Mingrelia,' CHARDIN remarks, 'there are women extremely handſome, of a majeſtic air, 'whoſe form and viſage are enchanting, and their aſpect attracts 'every beholder. Thoſe who are leſs handſome, or advanced in 'years, daub their fore-head, eye-brows, cheeks, noſe, and chin, 'with a coarſe paint. Others paint their eye-brows only, and are 'very attentive to their dreſs, which reſembles that of the Perſians. 'They uſe a veil, which covers only the crown and back part of the 'head. Though lively, civil, and affectionate, they are very perfidious; for there is no wickedneſs which they will not perpetrate, 'in order to procure, to preſerve, or to get rid of their gallants. 'The men likewiſe poſſeſs many bad qualities. All of them are 'trained to robbery, which they ſtudy both as a buſineſs and an 'amuſement. With great ſatisfaction they relate the depredations 'they have committed; and, from this polluted ſource, they derive 'their greateſt praiſe and honour. In Mingrelia, falſehood, aſſaſſi-'nation, and theft, are good actions; and whoredom, bigamy, and 'inceſt, are eſteemed as virtuous habits. The men marry two or 'three

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* Tavernier, tom. 1. p. 469.

'three wives at a time, and keep as many concubines as they chuſe. 'In this country, huſbands are not jealous of their wives. When a 'wife is detected in the act of infidelity, he has only a right to de- 'mand a pig from the gallant, who commonly eats a ſhare of it in 'company with both huſband and wife. To have many wives and con- 'cubines they conſider as a laudable practice; becauſe it enables them 'to beget the greater number of children, whom they either ſell for 'gold, or exchange for wares and proviſions *.' The Mingrelian ſlaves are not very dear. A man, from twenty-five to forty years of age, may be purchaſed for fifteen crowns; and, when farther advanced, for eight or ten. The fineſt girls, from thirteen to eighteen, coſt twenty crowns only, a woman about twelve, and children only three or four †.

The Turks, who purchaſe great numbers of theſe female ſlaves, are ſo intermixed with Armenians, Georgians, Arabians, Egyptians, and Europeans, that it is almoſt impoſſible to diſtinguiſh the original natives of Aſia Minor, Syria, and the reſt of Turkey. The Turks, in general, are robuſt, and pretty well made ‡. Among theſe people, crooked or deformed individuals are rarely to be ſeen. Moſt of their women are alſo very handſome and beautiful. They are exceedingly fair, becauſe they ſeldom go abroad, and never without their veils ‖. 'There is not,' ſays Belon, 'a woman in Aſia, however 'mean her condition in life, who has not a complexion freſh as a 'roſe, and whoſe ſkin is not fair, delicate, and as ſmooth as velvet. 'Before they go to bathe, they make an unguent of Chian earth, 'with which they anoint their whole bodies. Some of them paint 'the eye-brows of a black colour; and others eradicate the hairs

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* Chardin, p. 77.

† Ibid. p. 105.

‡ Thevenot, tom. 1. p. 55.

‖ Ibid. tom. 1. p. 105.

'with ruſma, and paint artificial eye-brows in the form of a black 'creſcent, which gives them a beautiful appearance at a diſtance, 'but, when viewed more near, they are very ugly. This cuſtom, how-'ever, is extremely antient*.' He adds, that, in Turkey, neither males nor females ſuffer the hair to grow on any part of their bodies, except on the head and chin; that they compoſe an ointment of equal quantities of ruſma and quick-lime, diluted in water, which they apply immediately before entering the warm bath; that, when they begin to ſweat, the hairs fall off by rubbing with the hand, and the ſkin remains ſmooth and ſoft, without the ſmalleſt veſtige of hair †. In Egypt, he farther remarks, there is a ſhrub called *alcanna*, the leaves of which, when dried and pounded, make a yellow or reddiſh paint, with which the women tinge their hair, hands, and feet ‡.

The Turkiſh women, to make their eye-brows of a deeper black, employ a preparation of tutty. They bathe often, uſe perfumes, and exert every effort to improve their beauty. The preſent natives of Judea reſemble the other Turks. But they are more ſwarthy than thoſe who live in Conſtantinople, or on the coaſts of the Black Sea, in the ſame manner as the Arabians are browner than the Syrians, becauſe they inhabit a more ſouthern climate. This obſervation is equally applicable to the Greeks: The inhabitants of the northern diſtricts are fairer than thoſe of the iſlands, or of the ſouthern provinces. The Greek women, in general, are ſtill more beautiful and vivacious than the Turkiſh. The Greeks eſteem large eyes, and elevated eye-brows, in either ſex, as great points of beauty ‖; and, it is not unworthy of remark, that, in all the medals and buſts of the antient Greeks, the eyes are much larger than in thoſe of the antient Romans.

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* Obſerv. de Pierre Belon, p. 199. † Ibid. ‡ Ibid. p. 136.

‖ Obſerv. de Belon, p. 200.

The inhabitants of Greece, of Naples, of Sicily, of Corſica, of Sardinia, and of Spain, who are ſituated nearly under the ſame latitude, have complexions extremely ſimilar. All theſe people are more ſwarthy than the French, the Britiſh, the Germans, the Moldavians, the Circaſſians, and the other natives of the northern parts of Europe, till we arrive at Lapland, where, as formerly remarked, we meet with men of a very different appearance. The Spaniards, though meagre, are a handſome people. Their features are regular, and their eyes beautiful: But their complexion is ſwarthy and yellowiſh. Their children, ſome time after birth, continue to be fair; but the operation of the ſun and air ſoon renders them yellow and tawny [*].

We are informed by **LINNAEUS**, that the Goths are tall; that their hair is as white as ſilver; and that the iris of their eye is bluiſh. He adds, that the Findlanders are muſcular and fleſhy; that their hair is of a whitiſh yellow colour; and that the iris of the eye is of a deep yellow [†]. The women of Sweden are ſaid to be very prolific. **RUDBECK** tells us, that the Swediſh women generally produce eight, ten, or twelve children; and that eighteen, twenty, twenty-four, and even thirty, are not uncommon. That the men, he adds, often exceed the age of a hundred years; that ſome of them arrive at a hundred and forty; and that one lived a hundred and fifty-ſix, and another a hundred and ſixty-one years [‡]. The author of the *Hiſtorical Voyages of Europe* confirms the obſervation of **RUDBECK**, that the Swedes are more famous for longevity than any other nation of Europe. He adds, that he ſaw ſeveral men who, he was aſſured by good authority, exceeded their hundred and fiftieth year *. He aſcribes this longevity of the Swedes to the ſalubrity of the air. With regard to Denmark, he makes the ſame remark: The Danes, ſays he, are robuſt and tall; of a lively and florid complexion, and, from the wholeſomeneſs of the air they reſpire, live to great ages: The Daniſh women are likewiſe fair, handſome, and very prolific †. Previous to the reign of CZAR PETER I. the Ruſſians were almoſt completely barbarous. They were born ſlaves; they were groſsly ignorant, brutal, cruel, and had neither courage nor urbanity of manners. Men and women went promiſcuouſly into the hot baths; and, like the Laplanders, after coming out of theſe baths, which were uncommonly hot, plunged themſelves into cold water. Their food was extremely coarſe ‡. But, even at this unrefined period, the women had the addreſs to colour their cheeks, to pull the hairs from their eye-brows, and to paint artificial ones. The Carelians and Ingrians, who inhabit the northern parts of Muſcovy, have conſtitutions vigorous and robuſt. In general, their hair is white or fair ‖. They reſemble the Findlanders, and ſpeak the ſame language.

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[*] Relation du Voyage d'Eſpagne, p. 187.

[†] Linn. Faun. Suec. p. 1.

[‡] See Olaii Rudbekii Atlantica.

The nations who inhabit the northern parts of Africa, from the Mediterranean to the Tropic, have already been deſcribed. The people beyond the Tropic, from the Red Sea to the Ocean, a vaſt extent of country, are a kind of Moors; but they are ſo ſwarthy, that they ſeem to be almoſt black. In general, the men are very brown; the women are ſomewhat fairer, well-made, and do not want beauty.

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* Les Voyages Hiſtoriques de l'Europe, tom. 8. p. 229. † Ibid. tom. 8. p. 279

‡ Relation curieuſe de Muſcovie, p. 181.

‖ Nouveaux Memoires ſur l'Etat de Grand Ruſſie, tom. 2. p. 64

ty. There is a great number of Mulattoes among theſe Moors, who are of a blacker colour; becauſe they are produced from Negroe women, who are purchaſed by the Moors, and with whom they have many children *. Under the 17th or 18th degree of north latitude, we meet with the Negroes of Nubia and of Senegal, both on the coaſt of the Red Sea, and on that of the weſtern ocean. From the 18th degree of north to the 18th of ſouth latitude, the whole inhabitants of Africa, except the Æthiopians or Abyſſians, are perfectly black. Hence that portion of the globe occupied by this race of men comprehends an extent of territory, parallel to the Equator, of about nine hundred leagues in breadth, and conſiderably more in length: Beyond the 18th or 20th degree of ſouth latitude, however, the natives ceaſe to be negroes.

The natural colour of the Ethiopians is brown or olive, like that of the ſouthern Arabs. They are tall, and have regular features, fine eyes, well proportioned noſes, thin lips, and white teeth. The Nubians, on the contrary, have flat noſes, thick lips, and their ſkin is extremely black †. Theſe Nubians are a ſpecies of Negroes, and have a great reſemblance to thoſe of Senegal. The Ethiopians are a half poliſhed people. They wear garments of ſilk and of cotton. They are very negligent in the culture of their lands; becauſe the citizens and vulgar are oppreſſed and plundered by the nobles. Each of theſe claſſes live ſeparately in their own hamlets or villages. They are fond of crude victuals; and the ſecond courſe in their feaſts conſiſts of raw fleſh, which they conſider as the greateſt delicacy. They have vines, but they make no wine. Their only beverage is an acid compoſition of tamarinds and water. Their knowledge

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* Marmol, tom. 3. p. 29, 33.

† Lettres Edifiantes, Recueil 4. p. 349.

knowledge of the arts and ſciences is very limited; for their language is rude, and their mode of writing is ſo imperfect, that they require ſeveral days to finiſh a common letter, though the characters of their alphabet are more beautiful than thoſe of the Arabians *.

Admiral **Drake**, in his voyage round the globe, mentions a ſingular fact, which has ſince been confirmed by **Hasselquist**. On the frontiers of the deſart of Ethiopia, he tells us, there are men called *Acridophagi*, or locuſt-eaters. They are black, meagre, very nimble, and of ſmall ſtature. During the ſpring, infinite numbers of locuſts are tranſported into their country by hot winds which blow from the weſt. As they have neither cattle nor fiſh, they are under the neceſſity of feeding upon theſe locuſts, of which they amaſs vaſt quantities. Theſe they cure with ſalt, and preſerve them for food through the whole year. This miſerable ſpecies of nouriſhment is ſaid to produce ſtrange effects: Theſe men ſeldom reach the age of forty years. When they approach to this period of life, caterpillars are engendered under their ſkin, which at firſt create a great itching, and become ſo prodigiouſly numerous, that their whole fleſh ſwarms with them. Theſe inſects firſt devour the belly, then the breaſt, and continue their ravages till they eat the whole fleſh from the bones.

In that tract of Ethiopia, which ſtretches to Cape Gardufu, there are immenſe deſarts. This eaſterly part of Ethiopia is almoſt entirely uninhabited. Ethiopia is bounded on the South by the Bedwins and ſome other nations, all of whom obſerve the Mahometan law, which corroborates the opinion, that the Ethiopians have originally ſprung from the Arabians, who have even ſpread themſelves along the coaſts of Melinda; for the inhabitants of theſe coaſts are only tawny, and follow the religion of Mahomet.[*]. The natives even of Zanguebar are not black, and moſt of them ſpeak the Arabic language. This country, though it lies under the Torrid Zone, is not exceſſively hot; and the hair of the natives, like that of the Negroes, is black and criſped [†]. Upon the whole of this coaſt, as well as in Moſambique and Madagaſcar, we find ſome white men, who muſt unqueſtionably have originated from other countries.

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* Voyages de Comp. de Holl. tom. 4. p. 34.

To form a juſt idea, however, of the varieties to be met with among theſe black nations requires a more minute examination. Upon comparing the teſtimonies of travellers, it appears, in the firſt place, that the varieties among the blacks are as numerous as thoſe among the whites. Both have their Tartars and Circaſſians. The natives of Guinea are very ugly, and emit an intolerable odour. Thoſe of Sofala and Moſambique have no bad ſmell, and are very beautiful. The blacks, therefore, may be divided into two different and principal races, that of the Negroes, and that of the Caffres. The firſt comprehends the blacks of Nubia, Senegal, Cape Verd, Gambia, Sierra-Leone, the Teeth and Gold Coaſts, that of Juda, Benin, Gabon, Loango, Congo, Angola, and of Benguela, as far as Cape Negro. Under the ſecond may be comprehended all the nations from Cape Negro to the point of Africa, where they are known by the appellation of *Hottentots*, and all thoſe on the eaſtern coaſt, within the ſame latitude, as the territories of Natal, Sofala, Monomotapa, Moſambique, and Melinda: The blacks of Madagaſcar and of the adjacent iſlands are likewiſe not Negroes, but Caffres. Theſe two races of men differ more from each other in colour than in features, hair, ſkin, or odour: Their diſpoſitions and manners are alſo very differ-

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[*] Pigafetta, p. 56.

[†] Marmol, p. 107.

ent. On a cloſer examination of the people who conſtitute theſe two races, we ſhall find as many varieties among the blacks as among the whites, and an equal number of ſhades from brown to black as, in the other race, from brown to white.

To begin with the nations and countries to the north of Senegal, and, proceeding along the coaſts, the different people which have been deſcribed by travellers ſhall be ſeparately deſcribed.

It is certain, in the firſt place, that the natives of the Canary iſlands are not negroes; for it is aſcertained by voyagers, that the original inhabitants of theſe iſlands were tall, handſome, and of a vigorous complexion; that the women were beautiful, and had fine hair; and that the inhabitants of the ſouthern parts of each iſland were more olive than thoſe of the northern *. In the hiſtory of his voyage to Lima, DURET informs us, that the antient inhabitants of the iſland of Teneriff were robuſt and tall, but tawny and meagre, and that, in general, their noſes were flat †. Theſe people, we ſee, poſſeſſed nothing in common with the Negroes, if their flat noſes be excepted. In the ſame latitude with theſe iſlands, the natives of Africa are Moors. They are very tawny; but, like the iſlanders, they belong evidently to the race of whites.

At Cape Blanc, the inhabitants are Moors, and follow the Mahometan religion. They wander, like the Arabs, from place to place, paſturing their camels, horſes, oxen, goats, and ſheep. They carry on a traffic with the Negroes, who give them two or three ſlaves for

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* L'Hiſtoire de la premiere decouverte des Canaries, par Bontier et Verriere, p. 251.

† L'Hiſt. gen. des Voyages, par M. l'Abbé Prevot, tom. 2. p. 230.

a camel, and eight or ten for a horſe [*]. Theſe Moors ſupply us with gum Arabic, which they have a practice of diſſolving in their milk. They ſeldom uſe fleſh as a diet, and never kill their cattle till they are about to die of diſeaſe or of old age [†]. The river Senegal divides the Moors from the Negroes. The Moors, who inhabit the north ſide of this river, are only tawny; but the Negroes, who live on the ſouth ſide of it, are perfectly black. The Moors wander about with their flocks; but the negroes are ſtationary, and dwell in villages. The former are free and independent; but the latter are the ſlaves of cruel tyrants. The Moors are meagre, ſmall in ſtature, and have a puny aſpect; but they are a ſly and an ingenious people. The negroes, on the other hand, are large, plump, and well-proportioned; but they are a ſimple and a ſtupid race.

Both on the ſouth and north ſides of the river Senegal, there is a ſpecies of men diſtinguiſhed by the appellation of *Foulies*, who form a ſhade between the Moors and Negroes, and, perhaps, have been produced by a commixture of the two nations. Theſe Foulies are not ſo black as the Negroes, but much more brown than the Moors; and thus hold a middle rank between the two. They are alſo more civilized than the negroes, follow the religion of Mahomet, and are hoſpitable to ſtrangers [‡].

Mulattoes form the chief inhabitants of the Cape de Verd iſlands. They ſprung from the Portugueſe who originally ſettled there and the native Negroes of theſe iſlands. They are called *Copper-coloured Negroes*; becauſe, though their features are the ſame with thoſe of the Negroes, they are not ſo black, but of a yellowiſh colour. They are a handſome and an ingenious people, but very idle and indolent.

They

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[*] Voyage du le Maire, p. 46.

[†] Ibid. p. 66.

[‡] Ibid. p. 75.

They procure their food chiefly by fiſhing and hunting. Their dogs are trained to kill the wild goats, which are very numerous in thoſe iſlands. Their wives and daughters are delivered, without reluctance, to the embraces of ſtrangers, for preſents of very ſmall value *.

The ſouthern banks of the Senegal exhibit the firſt genuine Negroes. Theſe people, as well as thoſe who live in that tract of country comprehended between this river and that of Gambia, diſtinguiſh themſelves by the name of *Jaloffs*. They are exceedingly black, handſome, and of a goodly ſtature. Their aſpect is by no means ſo diſagreeable as that of the other Negroes. The features of ſome of them, and particularly thoſe of the women, are very regular. They entertain the ſame ideas of beauty as the Europeans; for they are fond of fine eyes, ſmall mouths, thin lips, and well proportioned noſes. They differ, however, with regard to the baſis of the picture; for they eſteem a black ſhining colour as indiſpenſibly neceſſary to conſtitute a beauty. Their ſkin is very ſoft and fine; and, if we abſtract our prejudices in favour of particular colours, their women are as beautiful as in any other country in the world. In general, their females are handſome, gay, active, and amorous to an extreme degree. They ſhow a particular attachment to white men, whom they careſs with ardour, both to gratify themſelves, and in the hope of procuring preſents. In their intercourſe with foreigners, their huſbands lay them under no reſtraint. But, though they offer their wives, daughters, and ſiſters to ſtrangers, and think their honour injured by a refuſal; yet, when their wives tranſgreſs with men of their own nation, their jealouſy excites ſuch ferocity of paſſion, that they not unfrequently beat, and even cut themſelves with ſabres. Thoſe women, notwithſtanding, ſeldom want a tobacco-pipe out of their mouths; and, when heated, their ſkin emits a diſagreeable odour, though not ſo offenſive as that of the other Negroes. They are fond of dancing to the ſound of the drum and calabaſh. In theſe dances, all their movements conſiſt of laſcivious poſtures. They bathe often, and file their teeth, in order to make them more equal. Moſt of the young women engrave figures of animals, flowers, &c. on their ſkin, a practice common in Otaheite and other iſlands in the ſouthern ocean.

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* Voyages de Roberts, p. 387.

Among the Negroe women, when travelling, it is a general practice to carry their children on their backs. To this cauſe, ſome writers aſcribe the flat noſes and big bellies of the Negroes. The mother, in raiſing the child by ſudden jerks, makes its noſe ſtrike againſt her back; and the child, to avoid theſe frequent blows, keeps its head back and its belly forward *. Their hair is black, and criſped like curled wool. Their hair and colour conſtitute the chief difference between them and other men; for their features are not more different from thoſe of the Europeans, than the Tartarian viſages differ from thoſe of the natives of Britain. We are aſſured by Father TERTRE, that the flat noſes of the Negroes are occaſioned by a general practice of mothers, who depreſs the noſes of their new-born infants, and ſqueeze their lips, in order to thicken them; and that thoſe children who eſcape theſe operations, have elevated noſes, thin lips, and fine features. The Negroe women are very prolific. They bring forth with eaſe, and require neither midwife nor accoucheur. Child-bearing, with them, is attended with no troubleſome conſequences; for they fully recover their ſtrength by repoſing themſelves

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* Le Maire, p. 144.; Le Père du Jaric, p. 364.; et Le Père du Tertre, p. 493.

for a day or two. They are excellent nurſes, and treat their offspring with great tenderneſs and affection.

The Negroes who inhabit the Cape de Verd coaſt, and the iſland of Goree, are very black, but handſome. Though robuſt and ſtrong, they are indolent, and cultivate neither vines, corn, nor fruits. Fiſhes and millet conſtitute their principal articles of food; for they ſeldom eat fleſh. The Europeans they compare to horſes, becauſe they eat herbs. But they are ſo paſſionately fond of ſpirits, that they often ſell their parents, their children, and even themſelves, for brandy *. They wear only a cotton garment, which covers them from the middle of the body to one half of the thigh; becauſe, they allege, the heat of the climate prevents them from uſing any more clothes †.

Like the Negroes of Guinea, thoſe of Sierra-Leone are of a black colour, though leſs deep than that of the natives of Senegal. They paint their bodies with red and other colours. They alſo paint a ring round their eyes of a white, yellow, or red colour, and make different coloured ſtreaks upon their faces. Many of them cut figures of plants and animals upon their ſkin. Their women are ſtill more debauched than thoſe of Senegal. Though many of them are common proſtitutes, they incur neither cenſure, nor the ſmalleſt diſhonour. Both men and women wear ear-rings made of teeth, horns, ſhells, bits of wood, &c. which often weigh three or four ounces. Some pierce their noſtrils, or upper lips, for the purpoſe of ſuſpending ſimilar ornaments. Their clothing conſiſts of an apron made of the bark of trees, and covered with the ſkins of apes; and to thoſe ſkins they fix little bells. Their beds are made of ruſh-

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* Voyages de M. Gennes, p. 15.

† Lettres Edifiantes, Recueil 11. p. 48.

mats. They eat fiſh, or fleſh when it can be procured; but their chief food is yams and bananas [*]. Their principal paſſion is for women; and they are idle and inactive. Though in the near neighbourhood of rich valleys, hills covered with trees, green and fertile fields, beautifully interſected with brooks and rivers, they often continue to occupy wild and barren places. But their ſtupidity and indolence render them inſenſible to every pleaſure and advantage of this kind.

The Negroes of Guinea, though they have vigorous conſtitutions and enjoy good health, ſeldom arrive at old age. A Negroe of fifty years is a very old man. Their premature intercourſe with the females may be one cauſe, at leaſt, of the ſhortneſs of their lives. When very young, their children are allowed to indulge in every ſpecies of debauchery [†]. The Negroes of the iſlands of Annobona, St Thomas, &c. reſemble thoſe on the adjacent continent. Men and women go promiſcuouſly naked, except a ſmall apron round their middle [‡]. On the coaſts of Arada and Juda, the Negroes are not ſo black as thoſe of Senegal, Guinea, and Congo. To all other meat they prefer the fleſh of dogs. At their feaſts, a roaſted dog is commonly the firſt diſh preſented to their gueſts. This taſte is not peculiar to the Negroes; for the ſavages of North America, and of ſome Tartarian nations, are equally fond of the fleſh of dogs.

We are informed by PIGAFETTA, that the Negroes of Congo are leſs black than thoſe of Senegal. Though, in ſome individuals, the hair is red; yet, in general, it is black and criſped. The men are of a middle ſize. Some of them have brown eyes; in others, they are of a greeniſh colour. Their lips are not very thick; and, in their features, they have a great reſemblance to the Europeans *.

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[*] Indiae Orient. par. 2. in qua Johannis Hugonis Linſtcotani, &c. Navigatio, p. 11.

[†] Le Voyage de Guinée, par Boſman, p. 143.

[‡] Pyrard, p. 16.

They have very ſingular cuſtoms in certain provinces of Congo. For example, when a man dies in Loango, they place his corpſe, in a ſitting poſture, on an amphitheatre raiſed about ſix feet above the ground. He is then dreſſed in his beſt garments, and fires are kindled around him. In proportion as the moiſture is abſorbed by the clothes, he is covered with freſh ones, till the body is perfectly dry. After this, he is buried with great ſolemnity. In the province of Malimba, the huſband is ennobled by the wife. Upon the death of the King, if he leaves only a ſingle daughter at the age of puberty, ſhe becomes abſolute miſtreſs of the kingdom. Her reign is begun by making a tour through her dominions. In her paſſage through the different towns and villages, all the men are obliged to appear before her, and ſhe ſingles out the individual whom ſhe fancies moſt to paſs the night with her. When returned from her journey, ſhe ſends for the man who beſt pleaſed her, and inſtantly marries him. Immediately after marriage her power ceaſes, and devolves upon the huſband. Theſe facts are extracted from the Travels of M. DE LA BROSSE, along the coaſt of Angola, in the year 1738. He adds a fact not leſs ſingular. ‘ Theſe Negroes,’ he remarks, ‘ are extremely vindictive, of which I ſhall give a convincing proof. They daily demanded of us ſome brandy for the ‘ uſe of the King and chief men of the town. One day this requeſt ‘ was denied, and we had ſoon reaſon to repent it; for all the ‘ Engliſh and French officers having gone to fiſh on a ſmall lake ‘ near

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* Indiae Orient. part 1. p. 5.; Drake's Voyage, p. 110.

‘ near the ſea-coaſt, they erected a tent for the purpoſe of dreſſing
‘ and eating the fiſhes they had caught. When amuſing themſelves
‘ after their repaſt, ſeven or eight negroes, who were the chiefs of
‘ Loango, arrived in ſedans, and preſented their hands, according to
‘ the cuſtom of the country. Theſe Negroes privately rubbed the
‘ hands of the officers with a ſubtle poiſon, which acts inſtantaneouſ-
‘ ly; and, accordingly, five captains and three ſurgeons died on the
‘ ſpot.’

In Senegal, Gambia, Cape de Verd, Angola, and Congo, the Negroes are of a finer black than thoſe of Juda, Iſſigni, Arada, and the neighbouring provinces. When in health, they are totally black; but, when ſick, they become copper-coloured, or yellowiſh *. The Negroes of Angola are preferred in the French iſlands, on account of their ſtrength, to thoſe of Cape de Verd: But, when heated, they emit a ſmell ſo rank and offenſive, that they infect the places through which they paſs for more than a quarter of an hour. The Negroes of Cape de Verd do not ſmell ſo ſtrong as thoſe of Angola: They have likewiſe a finer ſkin; they are more handſome; their features are ſofter, and their diſpoſitions more gentle †. In Guinea, the Negroes are robuſt, and very fit for cultivating the ground, and other laborious employments. Thoſe of Senegal are not ſo ſtrong; but they are more ingenious, and better adapted for domeſtic ſervants ‡. We are informed by CHARLEVOIX, that the Negroes of Senegal are the moſt handſome and docile; that the Bambaras are larger, but that they are all thieves; that the Aradas are the beſt cultivators

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* Nouv. Voy. aux iſles de l'Amerique, tom. 4. p. 138.

† L'Hiſt. des Antilles, par le Pêre du Tertre, p. 493.

‡ Nouv. Voy. aux iſles de l'Amerique, tom. 4. p. 116.

tivators of the earth; that the Congos are the ſmalleſt in ſtature; that they are excellent fiſhers, but much addicted to deſertion; that the Nagos are the moſt gentle and humane, the Mondongos the moſt cruel and ferocious, the Mimes the moſt reſolute, but capricious, and very apt to deſpair; and that the Creole or Mungrel Negroes, from whatever nations they originate, retain little of their parents, but the colour and the abject ſpirit of ſlavery. They are more ingenious, but more ſlothful and debauched than the Negroes of Africa. **Charlevoix** adds, that the genius of the Guinea Negroes is very limited; that ſome of them appear to be almoſt entirely ſtupid, being unable to reckon beyond the number three; that their memories are extremely limited; the paſt and the future being equally unknown to them; that ſome of them are poſſeſſed of humour, and make tolerable mimics; that they are very cunning, and would die rather than reveal a ſecret; that they are gentle, humane, ſimple, credulous, and ſuperſtitious; but that they are brave, faithful, and, if properly trained to war, would make excellent ſoldiers *.

The Negroes ſeem not to be poſſeſſed of much genius; but their feelings are very acute. They are melancholy or gay, ſlothful or laborious, enemies or friends, according to the treatment they receive. When well fed, and not abuſed, they are contented, chearful, and ready for every kind of employment. But, when oppreſſed and maltreated, they become peeviſh, and not unfrequently die of melancholy. They are exceedingly ſenſible both of benefits and of abuſe. Againſt thoſe who injure them, they entertain a mortal hatred. But, when they have an affection for a maſter, to ſhow their zeal and attachment, there is not an office, however hazardous, which they will not execute with intrepidity. By nature, they are affectionate, and ardently love their children, friends, and countrymen *. Without any motive but that of compaſſion, they freely diſtribute the little they poſſeſs to the indigent and neceſſitous.

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* Hiſt. de St Dominique, par le Père Charlevoix.

The ingenious and humane COUNT DE BUFFON, when treating of this ſubject, makes the following manly reflections: 'The unfor-'tunate Negroes, as appears from their hiſtory, are endowed with 'excellent hearts, and poſſeſs the ſeeds of every human virtue. I 'cannot write their hiſtory, without lamenting their miſerable con-'dition. Is it not more than enough to reduce men to ſlavery, and 'to oblige them to labour perpetually, without the capacity of ac-'quiring property? To theſe, is it neceſſary to add cruelty and 'blows, and to abuſe them worſe than brutes? Humanity revolts 'againſt thoſe odious oppreſſions which reſult from avarice.—The 'Negroes are forced to labour; and yet the coarſeſt food is dealt out 'to them with a ſparing hand. They ſupport, ſay their obdurate 'taſk-maſters, hunger without inconvenience; a ſingle European 'meal is ſufficient proviſion to a Negroe for three days; however 'little they eat or ſleep, they are always equally ſtrong, and equally 'fit for labour †. How can men, in whoſe breaſts a ſingle ſenti-'ment of humanity remains unextinguiſhed, adopt ſuch deteſtable 'maxims? How dare they, by ſuch barbarous and diabolical argu-'ments, attempt to palliate thoſe oppreſſions which originate ſolely 'from their thirſt of gold? But, let us abandon thoſe hardened 'monſters to perpetual infamy, and return to our ſubject.'

We know little of the inhabitants of the coaſts and interior parts of

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* Hiſt. des Antilles, p. 483.

† Hiſt. de St Dominique, p. 468.

of Africa, from Cape Negro to Cape de Voltes, an extent of about four hundred leagues. Thus far, however, we know that theſe men are not ſo black as the other Negroes, and that they reſemble the Hottentots, with whom they border on the ſouth. On the contrary, the Hottentots are well known, and have been deſcribed by many voyagers. They are Caffres, and would be of a tawny colour only, if they did not bedaub their ſkin with black paint and greaſe. M. KOLBE, however, regards them as genuine Negroes. He informs us, that all of them have ſhort, black, criſped, and woolly hair *. M. KOLBE, however, tells us, that their colour is not totally black, but olive, though they employ every art to darken their ſkin. Their diſpoſitions are likewiſe different from thoſe of the Negroes; for the latter are cleanly ſedentary, and eaſily reconciled to ſervitude. But the Hottentots are diſguſtingly naſty; they are a wandering independent people, and very jealous of their liberty.

The inhabitants of the Cape of Good Hope are deſcribed by GAMA, who arrived in the Bay of St Helena in the year 1497, as being blackiſh, of ſmall ſtature, and having an aſpect extremely diſagreeable. He adds, that the ſound of their voice reſembled that of ſighing; that their clothing was the ſkins of beaſts; and that they armed themſelves with bludgeons hardened with fire, and pointed with the horn of ſome animal †. The Dutch voyagers tell us, that the ſavages north of the Cape are a ſmaller people than the Europeans; that they are of a reddiſh brown colour; that they are extremely ugly, and increaſe their blackneſs with paint ‡. In another place, they inform us, that the colour of the Hottentots reſembles that

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* Deſcription du Cap de Bonne Eſperance, p. 95.

† Hiſt. gen. des Voy. par l'Abbé Prevôt, tom. 1. p. 22.

‡ Voyages de la Comp. de Hollande, p. 218.

that of Mulattoes; that their countenances are very diſagreeable; that they are of a middle ſtature; that they are meagre, and exceedingly fleet in the chace; and that, when ſpeaking, their voice reſembles the clucking of a Turkey cock [*]: Father TACHARD tells us, that though the hair of the Hottentots be, in general, woolly, like that of the Negroes, many of them have long hair which hangs upon their ſhoulders. He adds, that ſome of them are as white as the Europeans, but that they diſguiſe their natural colour by covering their bodies with greaſe and the powder of a certain black ſtone; and that the women, though born fair, paint themſelves black with a view to pleaſe the men [†]. OVINGTON ſays, that the Hottentots are more tawny than the other Indians; that they have ſome reſemblance to the Negroes in features and colour, only they are not ſo black; neither is their hair ſo much criſped, nor their noſes ſo much flattened [‡].

It is apparent, from theſe and many other teſtimonies, that the Hottentots are not real Negroes, but blacks approaching to whiteneſs, in the ſame manner as the Moors are whites approaching to blackneſs. Theſe Hottentots are a ſingular race of people. Their females, who are generally much ſmaller than the men, have an excreſcence, or broad hard ſkin, which ariſes from the top of the os pubis, and hangs down, like an apron, till it reaches the middle of their thighs [‖]. All the women who are natives of the Cape are ſubject to this deformity, which they willingly uncover to any perſon who wiſhes to examine it. The men are all half eunuchs, not by nature, but by a moſt abſurd cuſtom of cutting out, about the age of eight years, one of their teſticles. M. **Kolbe** ſaw this operation performed. The circumſtances with which this religious ceremony is accompanied are ſingular. The prieſt rubs the boy with greaſe taken from the entrails of a ſheep; they lay him on his back, bind his hands and feet, and ſome of his friends hold him faſt in that poſition. The prieſt then proceeds, and with a ſharp knife cuts out the left teſticle. In its place, he puts a ball of greaſe of nearly the ſame ſize, accompanied with ſome medicinal herbs. The wound is then ſowed up with a needle made of the bone of ſome ſmall bird, and a thread from the tendon of a ſheep. The patient is then untied, and the prieſt rubs the whole body of the boy with greaſe ſo copiouſly, that it forms a kind of cruſt. In the next place, the operator, with his nails, makes furrows in this cruſt of greaſe, from one end of the body to the other, and then diſcharges his urine upon them. After this operation he again fills up the furrows with freſh greaſe. Theſe preparations being finiſhed, the boy is abandoned, and left alone in a condition reſembling death rather than life. He is then obliged to creep, in the beſt manner he can, into a hut erected near the place where the operation was performed. In this miſerable hovel, he either dies or recovers without aſſiſtance, or any other nouriſhment than the greaſe with which he is encruſted. In two days, he generally recovers, iſſues from his hut, and returns to his relations *.

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[*] Voyages de Spitſberg, p. 443.

[†] Le Premier Voy. du Prêre Tachard, p. 108.

[‡] Voyage d'Ovington, p. 194.

[‖] Deſcript. du Cap, par M. Kolbe, tom. 1. p. 91. and Voyage de Courlai, p. 291.

Though all the Hottentots have flat noſes, this would not happen to them, if their mothers did not compreſs them immediately after birth; for they conſider prominent noſes as great deformities. Their lips are very thick, their teeth are white; their eye-brows are buſhy, their heads large, their bodies meagre, and their limbs ſlender.

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* Deſcript. du Cap, par Kolbe, p. 275.

Their exiſtence ſeldom exceeds forty years. This limited duration of their lives is chiefly occaſioned by the naſtineſs in which they continually wallow, and the putrid fleſh which conſtitutes their principal food. The Dutch, ſays TAVERNIER, carried off a Hottentot girl a few days after birth, brought her up among themſelves, and her colour continued to be as white as that of any European. From this fact he draws the natural concluſion, that all the Hottentots would be equally fair, if they did not daub their bodies with black paint and greaſe.

In the territory of Natal, which ſtretches along the African coaſt beyond the Cape of Good Hope, the natives differ greatly from the Hottentots. They are better made, and leſs ugly. Nature has likewiſe made them blacker. Their viſages are oval, their noſes well proportioned, and their teeth white. Their general aſpect is agreeable, and their hair is criſped. Like the Hottentots, however, they are fond of greaſe; for they wear bonnets made of tallow. The height of theſe bonnets is from eight to ten inches. The tallow is well refined. They apply but little of it at a time, and mingle it ſo completely with their hair, that it never falls off *. M. KOLBE tells us, that theſe people do not ſtammer in their ſpeech like the Hottentots; that they build houſes, cultivate the ground, and ſow a ſpecies of maize, of which they make a fermented liquor †. Beyond Natal are the territories of Sofala and Monomotapa, where, according to PIGAFETTA, the natives are black, but taller and thicker than the other Caffres. Thoſe of Monomotapa, we are told by the Dutch voyagers, are black, tall, handſome, and have fine features. The girls wear no clothes but a piece of thin cotton ſtuff upon their middle.

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* Dampier, tom. 2. p. 393.

† Deſcript. du Cap, tom. 1. p. 136.

middle. When married, however, they put on garments. Though very black, theſe people differ from the Negroes. Their features are not ſo ugly; they emit no bad ſmell; and they can endure neither hard labour nor ſervitude.

The inhabitants of Madagaſcar and of Moſambique are more or leſs black. The hair of the natives of Madagaſcar is not ſo much criſped as thoſe of Moſambique. Neither of theſe people are genuine Negroes. Both men and women go perfectly naked. They eat the fleſh of elephants, and ſell the ivory to merchants [*]. Madagaſcar is inhabited by blacks and whites; the latter of whom, though tawny, ſeem to be a different race. The hair of the former is black and criſped; but that of the latter is more fair, leſs criſped, and much larger. It is remarked by FRANCIS CAUCHE, that theſe whites are probably of European extraction; for none of them whom he ſaw had flat noſes, like the Chineſe. He likewiſe informs us, that the Madagaſcar whites are fairer than the Caſtillans; that their hair is long; that even the blacks are not flat-noſed, like thoſe on the continent; and that their lips are not thick. There are alſo many perſons in this iſland of a tawny or olive colour, who probably proceed from a commixture of the whites and blacks. We are told by the ſame traveller, that the natives round the Bay of St Auguſtine are tawny; that they have no beards; that their hair is ſmooth and long; that they are a tall and handſome people; and that, though they probably never heard of Mahomet, the males are all circumciſed [†]. The firſt European ſettlement on this iſland was eſtabliſhed by the French; but it was ſoon abandoned *. Upon their arrival they ſaw the white men formerly mentioned; and they perceived that the blacks had a great reſpect for the whites †. Madagaſcar is a very populous iſland, and abounds in cattle and good paſturage. Both ſexes indulge much in debauchery; and public proſtitution is not reckoned diſhonourable. They are fond of ſinging, dancing, and ſimilar amuſements. Though naturally indolent, they know and practiſe ſome of the mechanical arts. They have no furniture in their houſes, but ſleep upon mats. Notwithſtanding this circumſtance, they have huſbandmen, carpenters, ſmiths, potters, and even goldſmiths. They eat their meat almoſt raw; and, after ſinging the hair, they devour the ſkins of their oxen. The vulgar go nearly naked; but drawers or petticoats of cotton or of ſilk are uſed by the more opulent ‡.

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[*] Recueil des voyages, tom. 3. p. 623.; Le Voy. de Moquet, p. 265.; et La Navigation de Jean Hugues Lintſcot, p. 20.

[†] Voyage de François Cauche, p. 45.

The inhabitants of the interior regions admit not of any accurate deſcription, becauſe we have too little knowledge of them. Thoſe whom the Arabians call *Zingues* are black, and nearly in a ſavage ſtate.

From the authorities which have been quoted, it appears that the Negroes are a different ſpecies of blacks from the Caffres. It is ſtill more apparent, however, that the differences in colour are the genuine effects of climate; and that the peculiarities in features have a great dependence upon the cuſtoms and practices obſerved by different nations, as thoſe of flattening the noſe, pulling the hair from the eye-brows, making the ears unnaturally long, the lips thick, the

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* Voyage de Flacour.

† Voyage de M. Delon.

‡ Le Voyage de Flacour, p. 90.; Struys, tom. 1. p. 32.; Pyrard, p. 38.

face broad, &c. We cannot have a ſtronger evidence of the influence of climate upon the colour of the human ſkin, than to find, under the ſame latitude, and diſtant from each other above one thouſand leagues, a race of men ſo ſimilar as thoſe of Nubia and of Senegal; and that the Hottentots, who have ſprung from the blacks, are the whiteſt people in Africa, ſolely becauſe the country they inhabit is the coldeſt.

The natives of Madagaſcar are called *Malegaches* or *Madecaſſes.* They are portly in their perſons, and generally exceed the middle ſtature. In their countenances, ſtriking marks of good nature and frankneſs are exhibited. They diſcover no deſire of learning any thing which has not a relation to the ſimpleſt wants of nature. An uncommon degree of careleſſneſs and apathy renders every thing unſupportable to them which requires any exertion of mind. They are ſober, ſprightly, and active, and ſpend their lives in alternate reſt and amuſement. To the Malegache, the preſent moment is to be enjoyed; he ſeems not to be ſuſceptible of foreſight; and he entertains not an idea that any man can give himſelf uneaſineſs about futurity. Theſe iſlanders are perfectly free beings, and, in general, enjoy health of body and tranquillity of mind. The Malegache is his own abſolute maſter. He has no reſtraint on his freedom. He acts and does what he pleaſes, except what may be injurious to his fellow creatures. He never attempts to aſſume an empire over the minds or actions of his neighbours. Each individual adopts his own mode of living, in which no body ever thinks of diſturbing him.

In Madagaſcar, the inhabitants are divided into a great number of tribes, which are all governed by particular chiefs. The lands are not divided, but belong to thoſe who take the trouble of cultivating them. Rice conſtitutes their chief food, though they likewiſe uſe butcher-meat and fiſh, of which laſt their ſeas and rivers afford great quantities, as well as a great diverſity of kinds. The power of their chiefs is much limited; but, in the province of Carcanaſſi, they are the ſuppoſed proprietors of all the land, which they diſtribute among their ſubjects, who pay a ſmall quit-rent only. It is not unworthy of remark, that, among theſe remote iſlanders, we can trace evident marks of the feudal laws of Europe. In this province, the people have ſome knowledge of writing. In the Madecaſſe language, there are a few hiſtorical compoſitions; but their learned men, who are denominated *Ombiaſſes*, uſe ſolely the Arabic characters. They have written treatiſes on medicine, geomancy, and judicial aſtrology. The Ombiaſſes are both phyſicians and ſorcerers, a conjunction not altogether, even in one of the moſt enlightened kingdoms of Europe, deſpiſed or aboliſhed, as we learn from the late famous narratives of the effects of *animal magnetiſm in Paris!* The moſt celebrated of theſe ſorcerers come from the province of Matatane, where magical tricks are in the higheſt eſtimation. The other natives of the iſland dread the Matatanes, becauſe they excel in this art of deception. In their public ſchools, the Ombiaſſes teach geomancy and aſtrology. The Arabs, who made a conqueſt of this iſland about three hundred years ago, taught the natives the art of writing; and the knowledge of the Arabian language is pretty general in ſeveral provinces of Madagaſcar.

It might have been expected, that the Mahometan religion ſhould have made a greater progreſs in this iſland, eſpecially when we conſider, that, for centuries, it has been ſo much frequented by the Arabs. If we except, however, circumciſion, abſtinence from pork, and ſome other inſignificant practices, which have little influence on general manners and conduct, even the deſcendents of the Arabs have forgotten or neglected the fundamental principles of their religion. They believe not in a future exiſtence. They admit, like the Manichees, of two principles in nature, the one ſupremely good, and the other extremely wicked. To the former they never addreſs their prayers, but continually do homage and offer up ſacrifices to the latter. The iſland of Madagaſcar is ſo contiguous to the coaſt of Africa, that it has moſt probably been peopled from that vaſt continent. But at preſent, however, the different races are ſo intermixed, that, to deſcribe all the varieties of them would be a vain and a uſeleſs attempt. The real race of Negroes, however, are eaſily to be diſtinguiſhed; but it is almoſt impoſſible to recognize thoſe who are deſcended from the whites.

Such of theſe iſlanders as poſſeſs any erudition relate, that the Creator of the heavens and the earth formed, from the body of the firſt man, whilſt he was aſleep, ſeven women, who were the mothers of their different ranks or caſts. The caſt of the Rhoandrians were formed from the firſt man's brain; that of the Aracandrians, from his neck; that of the Ontzatſi, from his left ſhoulder; that of the Vodziri, from his right ſide; that of the Ontzoa, from the thigh and the calf of the leg; and that of the Ondeves, from the ſoles of his feet. According to the parts of the body from which theſe caſts are ſuppoſed to have proceeded, their rank and importance are eſtimated.

It is impoſſible to peruſe this account of the origin of mankind, given by the natives of Madagaſcar, without recogniſing a moſt ſtriking reſemblance between it and that delivered to us by the moſt celebrated legiſlator Moses. Theſe eaſtern people cut ſeven women out of one man; but Moses contents himſelf with cutting one woman

man only out of the ſide of ADAM, our firſt progenitor; and EVE, the wife of ADAM, from the preſent population of this globe, ſeems to have been perfectly ſufficient to accompliſh the grand purpoſe for which ſhe was created.

In Madagaſcar, a plurality of wives is not uncommon, particularly among the chiefs and other rich individuals. But they never legally marry more than one; for the reſt are conſidered as concubines. This practice is not attended with thoſe diſagreeable conſequences which we ſhould naturally expect; for all theſe women live together in perfect harmony. Beſides, a divorce may be obtained whenever the conjugal union becomes diſagreeable either to the huſband or wife. In this iſland, adultery is regarded as a robbery, and receives the ſame puniſhment. Hence theſe people have the greateſt reſpect for a married ſtate. They caution ſtrangers to behave with decency to their wives; but, what is moſt ridiculouſly abſurd, they offer the uſe of their daughters to ſtrangers, and think themſelves highly honoured when the offer is accepted.

Before drawing general concluſions, we ſhall give a ſhort account of the natives of the New World. In the more northerly regions of America, we meet with a kind of Laplanders, who reſemble thoſe of Europe, or the Aſiatic Samoiedes. They are not numerous; but they occupy a great extent of territory. Thoſe who inhabit Davis's Straits are of a diminutive ſtature, have an olive colour, and thick, ſhort legs. They are expert fiſhers, and eat their fiſhes and their meat perfectly raw. Their drink conſiſts of water, or the blood of ſea-dogs. They are very robuſt, and live to a great age *. Theſe circumſtances conſtitute, in the moſt exact manner, the figure, the colour, and the manners

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* Hiſt. Nat. des Iſles, p. 189.

manners of the natives of Lapland. What is ſingular, the Fins, who are adjacent to the Laplanders of Europe, are a white, beautiful, pretty large, and handſome people; and, in the neighbourhood of the Laplanders of America, we meet with a race of men who are tall, pretty white, and poſſeſſed of regular features *. Along Hudſon's Bay, and to the north of Labrador, the ſavages are ſmall, ill-made, ugly, and ſeem not to belong to the ſame race with the former. Their faces, like thoſe of the ſavages of Jeſſo, are almoſt entirely covered with hair. In ſummer, they live in tents made of the ſkins of rein-deer; and, in winter, they dwell under ground, where the men and women ſleep promiſcuouſly. In Newfoundland, the ſavages have a reſemblance to thoſe of Davis's Straits. Their ſtature is low; they have little or no beard, large eyes, flat noſes, and broad faces. The traveller from whom this deſcription is taken, adds, that they are very ſimilar to the natives in the neighbourhood of Greenland †. Theſe ſavages ſpread over the northern regions of America; but, to the ſouth of them, we fall in with a more numerous and different race, who inhabit Canada, and the countries adjacent, as far as the territories of the Aſſiniboils. Theſe people are large, robuſt, and well proportioned; their hair and eyes are black, and their teeth white. Their colour is ſwarthy; they have ſcanty beards, and ſcarcely any hair on their bodies. In the chace they are extremely fleet, and, in travelling, indefatigable. They are a bold, grave, hardy people, and have ſo great a reſemblance to the oriental Tartars, that, if there were no difficulty concerning the poſſibility of their migration to the New World, we ſhould be apt to conclude that they had ſprung from the ſame origin. They likewiſe live under the ſame latitude, which is an additional proof of the powerful influence

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* Hiſt. Nat. des Iſles, p. 189.

† Recueil des Voyages au Nord, tom. 3. p. 7.

fluence of climate upon the colour and even the figure of human bodies. Thus, in the northern regions of the New as well as of the Old Continent, we, in the firſt place, find a race ſimilar to the Laplanders, and alſo white men with fair hair, like thoſe of the north of Europe; then a hairy race, like the ſavages of Jeſſo; and, laſtly, the ſavages of Canada, who ſtretch as far as the Gulf of Mexico, and have a ſtriking reſemblance to the European Tartars. This extenſive country, even on its firſt diſcovery, was very thinly inhabited. We are told by M. Fabry, who penetrated farther into North America than perhaps any other perſon, and where the ſavages, of courſe, could have ſuffered no diminution of population from the depredations of Europeans, that, in this region, he frequently travelled two hundred leagues without ſeeing a human creature, or perceiving any marks which indicated the adjacent country to be inhabited; and that, when he did meet with any Indian huts, they were generally diſtant from each other about one hundred leagues, and the whole inhabitants ſeldom exceeded twenty individuals. It is true, that, along the banks of rivers and lakes, they are more numerous, and ſometimes even troubleſome to the European coloniſts. In thoſe nations, however, the number of perſons ſeldom amounts to more than three or four thouſand, who are ſpread over a vaſt extent of country.

The multiplication of the human ſpecies, in every climate, depends more upon their union into a ſocial ſtate than any other circumſtance. Men, comparatively, would not be ſo numerous as the wild quadrupeds, if they did not derive mutual ſupport from each other. The biſons, or wild oxen of North America, exceed perhaps, in numbers, thoſe of the human ſpecies. But, though population be one reſult of ſociety, their increaſed numbers give riſe to and ſtrengthen their union. Hence it may be preſumed, that the want of civilization in the New World is chiefly owing to its being thinly inhabited; for though, originally, each nation exhibited different manners and cuſtoms; though ſome of them were more daſtardly, cruel, and ſavage than others; yet they were all ignorant, ſtupid, and equally deſtitute of induſtry and of arts.

Though North America, however, affords ſavages only, Mexico and Peru preſented to the view of Europeans a civiliſed people governed by laws and by regal eſtabliſhments. They were poſſeſſed of arts, of induſtry, and of religion. They lived in cities, where the ſovereign, by his authority, maintained order and police. Theſe people, who, at the time of their being diſcovered, were exceedingly numerous, cannot be regarded as new nations, or, by reaſon of their remoteneſs, as originating from individuals who had paſſed the Atlantic from the Old Continent. The inhabitants of Florida, along the Miſſiſippi, and of the more ſoutherly regions, are more tawny than thoſe of Canada. The paint and oil with which they beſmear their bodies, make their colour unnaturally olive. We are informed by COREAL, that, in Florida, the women are ſtrong, tall, and, like the men, of an olive colour; that they paint their arms, legs, and bodies, with different colours, which remain perpetually, becauſe, by the operation of puncturing, they are indelibly engrained in the ſkin; that the olive colour does not proceed ſo much from the heat of the climate, as from the oil with which their ſkins are varniſhed. He farther tells us, that the women are very active; that they ſwim acroſs broad rivers, each with an infant in her arms; and that they climb with agility the higheſt trees [*]. The whole of theſe qualities they poſſeſs in common with the Canadians and the other ſavages of America.

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[*] Le Voyage de Coreal, tom. 1. p. 36.

It is remarked by Father du TERTRE, that the Caribbees are, in general, tall, and have an agreeable aſpect; that they are healthy, ſtrong, and active; that the countenances of ſome of them are flat, and their noſes depreſſed: But theſe features are not natural; they are induced artificially, ſoon after birth, by the parents. Moſt of the Caribbees have ſmall, black eyes, long, ſmooth, black hair, and white teeth. Their colour is tawny or olive. This colour is the effect of Nature, and not of art; for their offspring, who have been brought up in Europe, and denied the uſe of paint, had the ſame colour with that of their parents. Theſe ſavages, though cruel to their enemies, are naturally of a mild and compaſſionate diſpoſition. Without diſtinction, they marry ſtrangers, or their own mothers; and many of them poſſeſs, at the ſame time, two ſiſters, or the mother and daughter, and even their own daughter. With regard to their wives, the men pardon, with the greateſt eaſe, their unfaithfulneſs; but they never forgive the man who debauches them. They feed upon crabs, turtles, fiſhes, lizards, and ſerpents, which they ſeaſon with pimento, and the powder of manioc *. As they are indolent to exceſs, and accuſtomed to an unreſtrained independence, they can never, like the Negroes, be reconciled to any regular kind of labour. They exert every effort to preſerve their liberty, and, rather than work, they will die of hunger, or of melancholy. The Arrouaguas, who have milder diſpoſitions than the Caribbees, are ſometimes employed as labourers, but only in their favourite exerciſes of hunting or fiſhing. The Braſilian ſlaves have nearly the ſame diſpoſitions. They are not, how-

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* Hiſt. gen. des Antilles, par du Tertre, tom. 2. p. 453.

ever, ſo indolent, ſtupid, and melancholy, as the other ſavages of America. When gently treated, they will ſubmit to any manual operation, except that of cultivating the ground, which they regard as the greateſt mark of ſlavery.

The female Caribbees are fat, and pretty handſome. Their eyes and hair are black, their mouths ſmall, their teeth white; and they are reſerved and modeſt in their behaviour. They uſe paint; but they do not, like the men, make black lines on their faces and other parts of the body. They wear ſmall aprons only, which are made of cotton, ſtudded with beads, and eight or ten inches in breadth, by five or ſix in length. Beſide theſe aprons, which they purchaſe from the Europeans, they employ collars of the ſame cloth, which hang down upon their breaſts. Of this ſtuff they likewiſe wear bracelets, and ear-rings compoſed of ſtrings of beads, or made of a blue ſtone. The only other ornament peculiar to the women is a buſkin of cotton ſtudded with beads, which extends from the calf of the leg to the ankles. When girls attain the age of puberty, they are allowed aprons and buſkins, the laſt of which are made ſo ſtrait, that they cannot be removed. This apparatus prevents the lower parts of the legs from thickening, and the upper parts, of courſe, grow larger and ſtronger *.

In Mexico and Peru, the inhabitants are ſo intermixed, that it is difficult to ſee two countenances of the ſame complexion. The city of Mexico is compoſed of Europeans, ſouth and north American Indians, Negroes of Africa, Mulattoes, and Mongrels of every ſpecies †. The genuine natives are olive and brown, nimble, and well-proportioned.

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* Nouv. Voy. aux. Iſles, tom. 2. p. 8.

† Lettres Edifiantes, Recueil 11. p. 119.

tioned. On their eye-brows, their hair is ſcanty, but that on their heads is black and very long *.

We are informed by WAFER, that, in the Iſthmus of America, the natives are of a good ſtature and ſhape. They have elegant limbs, a full cheſt, and are remarkably fleet in the chace. The women are ſhort and ſquat. Both ſexes have round faces, flat ſhort noſes, large eyes, generally of a grey colour, and very brilliant, prominent fore-heads, thin lips, white teeth, and very regular features. Their hair is long, black, and ſtraight; and, if they did not pull out the hairs, the men would have beards. Their colour is tawny, and their eye-brows are black.

Theſe people, however, are not the only natives of this Iſthmus. There are among them a ſpecies of white men, whoſe colour reſembles that of milk. Their bodies are covered with a ſhort white down; which, upon the face, is not ſo thick as to conceal the ſkin. Their hair, as well as their eye-brows, are perfectly white. Theſe Indians are ſhorter than the others; and it is ſingular, that their eye-lids have the form of creſcents, with the points turned downward. Their eyes are ſo weak, that, during the day, they have no diſtinct perception of objects. They ſee beſt by the mild light of the moon. They cannot endure hard labour. During the day they ſleep, and ſeldom go abroad but in the night. When the moon ſhines, they run nimbly through the deepeſt ſhades of the foreſts, with as much eaſe and ſafety as other men do in the brighteſt day. Theſe men, upon the whole, are by no means ſo vigorous as the other Indians. They conſtitute a peculiar and diſtinct race. It ſometimes happens, however, that a copper-coloured male and female produce one

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* Voy. de Coreal, tom. I. p. 116.

one of theſe white children. **Wafer**, from whom theſe facts are enumerated, tells us, that he had ſeen children of this kind when they exceeded not their firſt year *. If this narrative be true, the conſtitution and the colour of theſe white Indians muſt be a kind of diſeaſe derived from their parents. But, if they are produced by thoſe of a copper colour, then they muſt form a diſtinct race, reſembling the Chacrelas of Java, and the Bedas of Ceylon. But, if theſe whites really proceed from copper-coloured parents, it muſt likewiſe be allowed, that the Bedas and Chacrelas have been produced by tawny progenitors; and that they form not a particular race, but are only individuals, who, by ſome accidental and unknown cauſe, have aſſumed a colour different from that of their original ſtock.

This laſt idea ſeems to be the moſt probable. The occaſional production of whites by Negroe parents adds great force to this theory. We have deſcriptions of two white Negroes in the Hiſtory of the French Academy. 'I have ſeen one of them,' ſays the **Count de Buffon**, 'and am aſſured that they are very frequent among the 'Negroes of Africa †. What I have ſeen, independently of the relations of voyagers, leaves me no room to doubt concerning the origin of theſe white Negroes. They are only Negroes who have degenerated from their race, and not a particular permanent ſpecies 'of men: In a word, they are among the Negroes what **Wafer** tells 'us the white Indians are among the yellow or copper-coloured Indians of Darien, and, probably, what the Chacrelas and Bedas are 'among the brown Indians of the Eaſt. It is ſingular, that this variation of Nature takes place only from black to white, and not 'from white to black. It is no leſs ſingular, that all the people in 'the Eaſt Indies, in Africa, and in America, where theſe white men

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* Dampier, tom. 4. p. 252.

† Venus Phyſique.

'appear, lie under the ſame latitude: The Iſthmus of Darien, the
'Negroe country, and the iſland of Ceylon, are under the very ſame
'parallel. White, then, appears to be the primitive colour of Na-
'ture, which may be varied by climate, by food, and by manners,
'to yellow, brown, and black, and which, in certain circumſtances,
'returns, but ſo greatly altered, that it has little or no reſemblance
'to the original whiteneſs.'

The two extremes of blackneſs and whiteneſs continually approach each other. In her moſt ſeemingly perfect exertions, Nature made men white, and, after undergoing every poſſible ſhade, ſhe ſtill renders them white. But the ſpecific whiteneſs is very different from the accidental. We have ſimilar examples in the vegetable kingdom. A white flower, even in the quality of whiteneſs, is very different from a red one which has been rendered white by froſt, or by excluſion from light.

The Indians of Peru, and eſpecially thoſe who live in the plains and along the ſea-coaſts, are, like the inhabitants of the Iſthmus, of a copper colour. But thoſe who occupy the elevated parts of the country between the two ranges of the Cordeliers, are almoſt as white as the Europeans. In Peru, ſome parts of the country are a league higher than others, which produces a greater variation on the temperature of the climate than an hundred leagues of latitude. The Indians of Guiana, and along the river of the Amazons, are all more or leſs of a tawny reddiſh colour. CONDAMINE tells us, that the differences in the ſhades are chiefly occaſioned by the temperature of the air, which varies from the heat of the Torrid Zone, to the great colds produced by the neighbourhood of the ſnow *: That the Oma-

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* Voy. de la Condamine, p. 49.

guas, and ſome other ſavages, flatten the faces of their children by lacing their heads between two boards *; that others pierce the noſtrils, lips, or cheeks, and place in them feathers, the bones of fiſhes, and ſimilar ornaments; that moſt of them bore their ears, and, inſtead of ear-rings, employ herbs and flowers †. In Braſil, the ſavages are nearly of the ſame ſize with the Europeans; but they are ſtronger, and more agile: Neither are they ſubjected to ſo many diſeaſes; and their longevity is great. Their hair is black, and ſeldom grows hoary with age. Their colour is tawny, or a mixture of red and brown. Their heads are large, their ſhoulders broad, and their hair is long. They pull the hairs out of their beards, their eyebrows, and all parts of their bodies, which makes them have an uncommon and a ferocious appearance. Their under lip they pierce, and as an ornament inſert into it a green ſtone, or a ſmall poliſhed bone. Immediately after birth, the mothers flatten the noſes of their children. The whole of them go abſolutely naked, and paint their bodies with different colours. Thoſe who inhabit the ſea-coaſts are now ſomewhat civilized by their intercourſe with the Portugueſe; but moſt of thoſe who occupy the interior parts of the country are ſtill ſavages. A ſavage people are not to be civilized by force or by ſlavery. In theſe ſavage nations, the miſſionaries have poliſhed more men than the arms of thoſe princes by whom they were ſubdued. The ferocity and ſtubbornneſs of the ſavages of Paraguay were conquered by the humanity, the gentleneſs, and the venerable example of the miſſionaries. They frequently begged to be inſtructed in that law by which men were rendered ſo perfect; and they often followed its precepts, and united with ſociety ‡. In general, the natives of Paraguay

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* Voy. de la Condamine, p. 72.

† Ibid. p. 48.

‡ Voy. de Lery, p. 108.; Coreal, tom. 1. p. 163.; Mem. pour ſervir a l'hiſt. des Indes, p. 287.; L'Hiſt. des Indes, par Maffé, p. 71.; Pyrard, tom. 2. p. 337.; Lettres Edifiantes, Recueil 15. p. 331. &c.

Paraguay are tall and well-proportioned. Their countenances are long, and their ſkin is olive-coloured *.

We are informed by **Frezier**, that the natives of Chili, like thoſe of Peru, are tawny, their colour reſembling reddiſh copper. This colour differs from that of the Mulattoes, who, as they are produced by the commixture of whites and blacks, are of a brown colour, or a mixture of black and white. On the contrary, the South American Indians are yellow, or rather reddiſh. In Chili, the inhabitants are of a middle ſize. They have large cheſts, thick limbs, ſmall eyes, long ears, ſtraight, buſhy, black hair, and countenances by no means agreeable. They pull the hairs out of their beards, and lengthen their ears. Though the climate is not hot, they generally wear no clothes, except a ſkin thrown over their ſhoulders.

It has been alleged, that, on the confines of Terra Magellanica, and near the extremity of Chili, there exiſts a gigantic race of men. **Frezier** tells us, truſting to the authority of ſome Spaniards, that theſe men are nine or ten feet in height. Theſe gigantic men, he remarks, are called *Patagonians*, and live on the eaſtern parts of the coaſt. This ſtory of the Patagonians was afterwards conſidered as fabulous, becauſe the Indians along the Straits of Magellan were found not to exceed the common ſtature of mankind. This circumſtance, he continues, might have deceived **Froger**, in his narrative of the voyage of M. **de Gennes**; for both ſpecies of men are ſaid to have been ſeen by the crew of the ſame veſſel. The crew of the James of St Malo, we are told, ſaw, in Gregory Bay, in the year 1709, ſeven of theſe giants; and the crew of the St Peter of Marſeilles ſaw ſix of them, to whom they offered bread, brandy, and wine, which, though they had given preſents of arrows to the ſailors, and aſſiſted them in bringing the ſhip's boat aſhore, they refuſed *. As M. DE **FREZIER**, however, does not ſay that he had ſeen any of theſe gigantic ſavages, and as the relations concerning them are full of exaggerations upon other ſubjects, the exiſtence of a race of giants, ſo high as ten feet, muſt ſtill remain problematical. The bodies of ſuch men muſt be eight times the bulk of thoſe of ordinary perſons. About five feet is the mean height of the human ſpecies; and the extremes ſeldom exceed a foot above or below this ſtandard. Giants and dwarfs who exceed theſe terms are accidental varieties only, and not diſtinct and permanent races. Beſides, if theſe Magellanic giants have any exiſtence, their numbers muſt be very ſmall; for the ſavages found along the Straits, and in the adjacent iſlands, are of a middle ſize. They are of an olive colour; and they have large cheſts, ſquat bodies, thick legs, and ſtraight black hair †. In fine, their ſtature does not exceed the ordinary ſize, and, both in colour and hair, they reſemble the other Americans.

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* Coreal, tom. 1. p. 240. and 259.; Lettres Edifiantes, Recueil 11. p. 391.; Ibid. Recueil 11. p. 391.; and Recueil 12. p. 6.

In conducting a narrative of this nature, compiled from a multiplicity of voyages written by various authors, and in different languages, it muſt of neceſſity, aſſume a deſultory appearance. But, as the great object of this chapter is, to give conciſe ideas concerning the ſituation, character, manners, religion, and government of mankind almoſt from the South to the North Pole, every indulgence is to be expected from an intelligent reader. To accompliſh this purpoſe,

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* Voy. de Frezier, p. 75.

† Coreal, p. 231. and 284.; l'Hiſt. de la conquête des Moluques, par Argenſola, tom. 1. p. 35. and 255.; Le Voy. le M. de Gennes, par Froger, p. 97.; Les Voy. de la Comp. d'Holl. tom. 1. 651.; Dampier, p. 179.

poſe, the quantity of reading is immenſe; but the uſe I have made of it, others muſt determine.

With this view, leaving the weſt coaſt of America, I ſhall proceed to give a curſory account of the inhabitants of ſome of the iſlands in the South Sea or Pacific Ocean.

Before proceeding to more particular obſervations, one general remark cannot eſcape notice. The natives of the numerous iſlands ſcattered through this immenſe ocean, admit of two obvious and characteriſtic diviſions, namely, the *friendly*, *generous*, and *hoſpitable*; and the *barbarous*, *brutal*, and *hoſtile*.

On each of theſe ſubjects particular examples can only be exhibited.—At Otaheite and ſeveral other iſlands, the natives, as a mark of intended friendſhip, uniformly preſent, like the northern nations of old, green branches of trees. When Captain COOK and his aſſociates anchored in a fine bay, called *Motavai* *, they were inſtantly ſurrounded by the natives in their canoes, who exchanged cocoanuts, bread-fruit, and ſome ſmall fiſhes, for beads and ſimilar trifles. 'The bread-fruit,' Captain COOK informs us, 'grows on a tree 'that is about the ſize of a middling oak. Its leaves are frequently 'a foot and an half long, of an oblong ſhape, deeply inſinuated like 'thoſe of the fig-tree, which they reſemble in conſiſtence and colour, 'and in the exuding of a white milky juice upon being broken. 'The fruit is about the ſize and ſhape of a child's head; and the 'ſurface is reticulated, not much unlike a truffle. It is covered 'with a thin ſkin, and has a core about as big as the handle of a 'ſmall knife. The eatable part lies between the ſkin and the core:

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* April 13. 1769.

‘ It is as white as ſnow, and ſomewhat of the conſiſtence of new
‘ bread. It muſt be roaſted before it is eaten, being firſt divided
‘ into three or four parts. Its taſte is inſipid, with a ſlight ſweet-
‘ neſs, ſomewhat reſembling that of the crumb of wheaten bread
‘ mixed with a Jeruſalem artichoke *.’

In this voyage, Captain COOK was attended by the celebrated Mr BANKS, (now Sir JOSEPH), and Dr SOLANDER, gentlemen highly qualified for ſcrutinizing every department of Nature, whether animal, vegetable, or mineral. When they landed, they were amicably received by ſome hundreds of the inhabitants, though the latter were ſtruck with ſuch awe, that the firſt who approached crept almoſt upon his hands and knees. He, however, preſented the uſual ſymbol of peace, a green branch of a tree. Captain COOK and his company took a walk for ſome miles in the woods, attended by a numerous train of natives, who had now relinquiſhed their timidity and become familiar. ‘ As we went along,’ Captain COOK remarks,
‘ we diſtributed beads and other ſmall preſents among them, and
‘ had the ſatisfaction to ſee that they were much gratified. Our
‘ circuit was not leſs than four or five miles, through groves of trees,
‘ which were loaded with cocoa-nuts and bread-fruit, and afforded
‘ the moſt grateful ſhade. Under theſe trees were the habitations
‘ of the people, moſt of them being only a roof without walls; and
‘ the whole ſcene realized the poetical fables of Arcadia †.’

A curious cuſtom, though practiſed by ſome other iſlanders, was here exhibited. ‘ Two men,’ ſays Captain COOK, ‘ of ſuperior
‘ rank came on board, and each ſingled out his friend; one of them,
‘ whoſe name was found to be *MATAHAH*, fixed upon Mr BANKS,
‘ and

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 80.

† Ibid. p. 83.

‘ and the other upon me. This ceremony conſiſted in taking off ‘ great part of their clothes and putting them on us. In return for ‘ this, we preſented each of them with a hatchet and ſome beads *.’ After this interchange of preſents with TOOTAHAH, the natives, both males and females, continues Captain COOK, ‘ attended us to ſeveral ‘ large houſes, in which we walked about with great freedom. The ‘ ladies ſhowed us all the civility of which, in our ſituation, we ‘ could accept; and, on their part, ſeemed to have no ſcruple that ‘ would have prevented its being carried farther †.’ Next day, Captain COOK and his aſſociates took leave of their friendly chief, and directed their courſe along the ſhore. In their walk, they met, at the head of a numerous train of people, another chief, called *TUBOURAI TAMAIDE*, with whom amity was eſtabliſhed by mutually exchanging branches of trees, putting their hands on their left breaſts, and pronouncing the word *Taio*, which ſignifies *friend*. The chief then invited them to eat, which offer they readily accepted, and made a hearty meal upon fiſh, bread-fruit, cocoa-nuts, and plantains. ‘ During this viſit,’ continues Captain COOK, ‘ a wife ‘ of our noble hoſt, whoſe name was *TOMIO*, did Mr BANKS the ‘ honour to place herſelf upon the ſame matt, cloſe by him. TOMIO ‘ was not in the firſt bloom of her youth; nor did ſhe appear to ‘ have been ever remarkable for her beauty. He did not, therefore, ‘ I believe, pay her the moſt flattering attention. It happened too, ‘ as a farther mortification to this lady, that, ſeeing a very pretty ‘ girl among the crowd, he, not adverting to the dignity of his ‘ companion, beckoned to her to come to him. The girl, after ſome ‘ intreaty, complied, and ſat down on the other ſide of him. He ‘ loaded her with beads, and every ſhowy trifle that could pleaſe her. ‘ His Princeſs, though ſhe was ſomewhat mortified at the preference ‘ that

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[*] Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 84.

[†] Ibid. p. 85.

‘ that was given to her rival, did not diſcontinue her civilities, but ‘ ſtill aſſiduouſly ſupplied him with the milk of the cocoa-tree, and ‘ ſuch other dainties as were in her reach.’ In ſimilar circumſtances, could any Princeſs in Europe have conducted herſelf with more dignity, politeneſs, and propriety ?

At firſt ſight, there appears a ſingular trait in the character of the natives even of Otaheite, and other friendly and placid iſlanders. They are all arrant thieves, and can pick pockets with the dexterity of the moſt expert London blackguard *. Their thefts, however, admit of the ſtrongeſt apology. We do not learn that they ſteal from each other, but from ſtrangers, who exhibit ſuch uncommon and alluring objects, that the temptation is almoſt irreſiſtible †. The accuracy and expedition, however, of their police is aſtoniſhing. A complaint of this kind is no ſooner made to a chief, than he inſtantly deſpatches his meſſengers ; and the thieves are apprehended and the ſtolen articles reſtored in a few hours. Upon this ſubject, Captain COOK, with much propriety, remarks, that theſe people ‘ ſhow an intelligence and influence which would do honour to any ‘ ſyſtem of government, however regular and improved ‡.’ But, he afterwards remarks, ‘ That the people of this country, of all ranks, ‘ men and women, are the arranteſt thieves upon the face of the ‘ earth ‖.’

As an apology for the thieviſh diſpoſition of theſe ignorant and innocent people, Captain COOK, with much humanity and good ſenſe, remarks, ‘ That we muſt not eſtimate the virtue of theſe ‘ people by the only ſtandard of morality, the conformity of their ‘ conduct

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* See Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 87. *et alibi paſſim.*

† This idea is contradicted, Ibid. p. 170. ‡ Ibid. p. 88. ‖ Ibid. p. 100.

‘ conduct to what in their opinion is right; but we muſt not haſti-
‘ ly conclude, that theft is a teſtimony of the ſame depravity in them
‘ that it is in us, in the inſtances in which our people were ſufferers
‘ by their diſhoneſty; for their temptation was ſuch, as to ſurmount
‘ would be conſidered as a proof of uncommon integrity among
‘ thoſe who have more knowledge, better principles, and ſtronger
‘ motives to reſiſt the temptations of illicit advantage. An Indian
‘ among penny knives and beads, or even nails and broken glaſs, is
‘ in the ſame ſtate of trial with the meaneſt ſervant in Europe among
‘ unlocked coffers of jewels and gold *.’

The principal object of this voyage was to make obſervations on a tranſit of the planet Venus over the Sun's diſk; which, to the immortal honour of his Majeſty GEORGE III. was performed under his auſpices. This tranſit happened on the third day of June 1769; and the reader may ſee a particular deſcription of it in the Philoſophical Tranſactions, vol: 61. part 2. p. 379. *et ſeqq.*

With regard to *funeral rites*, the people of theſe iſlands never *bury* their dead under ground. About this time died an old woman of ſome rank, who was related to TOMIO, which gave our voyagers an opportunity of obſerving how theſe people diſpoſe of their dead.
‘ In the middle of a ſmall ſquare, neatly railed in with bamboo, the
‘ awning of a canoe was raiſed upon two poſts, and under this the
‘ body was depoſited upon a frame. It was covered with fine cloth;
‘ and near it was placed bread-fruit, fiſh, and other proviſions. We
‘ were informed by our friend TUBOURAI TAMAIDE, that the food
‘ was placed there as an offering to their gods. In the front of the
‘ area was a kind of ſtile, where the relations of the deceaſed ſtood
‘ to

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[*] Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 102.. 148.

'to pay the tribute of their ſorrow; and under the awning were 'innumerable ſmall pieces of cloth, on which the tears and the blood 'of the mourners had been ſhed; for, in their paroxyſms of grief, 'it is an univerſal cuſtom to wound themſelves with the ſhark's 'tooth *.' This cuſtom, of expreſſing grief by wounding themſelves, is not peculiar to any nation. Even in the civilized nations of Europe, extreme grief is often expreſſed by violently beating the breaſt, tearing the hairs from the head, and ſometimes by actual ſuicide. The practice of expoſing the dead above ground, till the fleſh is conſumed by putrefaction, and afterwards burying the bones, does not admit of an eaſy explanation. It is worthy of remark, however, that ÆLIAN and APOLLONIUS RHODIUS mention a ſimilar cuſtom among the antient inhabitants of Colchis, a country of Aſia now known under the appellation of *Mingrelia*. This manner of treating the dead, however, was not extended to both ſexes. The men were wrapped in a hide, and hung up in the air by a chain; but the women were buried in the earth: A diſtinction which might originate from the extreme jealouſy, or rather delicacy, of the Aſiatics.

In a morning walk, Mr BANKS met a number of natives, whom he diſcovered to be a band of *muſicians*. Having learnt where they were to ſpend the evening, Mr BANKS and the other gentlemen gave their attendance. The band conſiſted of two players on the flute and three drummers. The drummers accompanied the muſic with their voices; and the gentlemen were not a little ſurpriſed to diſcover that *they* were generally the ſubject of the ſong. 'We did 'not expect,' ſays Captain COOK, 'to have found, among the un-'civilized inhabitants of this ſequeſtered ſpot, a character which has 'been the ſubject of ſuch praiſe and veneration, where genius and

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 142.

'knowledge have been moſt conſpicuous; yet theſe were the bards 'or minſtrels of Otaheite. Their ſong was unpremeditated, and accompanied with muſic; they were continually going about from 'place to place; and they were rewarded by the maſter of the 'houſe, and the audience *.'

On the 29th day of June 1769, Captain COOK and the other gentlemen went to the diſtrict called *Paparra*, the property of their friends OAMO and OBEREA, where they meant to ſleep. 'We 'went on ſhore about an hour before night, and found that they 'were both abſent, having left their habitations to pay us a viſit at 'Matavai. This, however, did not alter our purpoſe. We took 'up our quarters at the houſe of OBEREA, which, though ſmall, 'was very neat, and, at this time, had no inhabitant but her father, 'who received us with looks that bid us welcome. Having taken 'poſſeſſion, we were willing to improve the little day-light that was 'left us; and therefore walked out to a point, upon which we had 'ſeen, at a diſtance, trees that are here called *Etoa*, which generally diſtinguiſh the places where theſe people bury the bones of their 'dead. Their name for ſuch burying-grounds, which are alſo 'places of worſhip, is *Morai*. We were ſoon ſtruck with the ſight 'of an enormous pile, which, we were told, was the Morai of 'OAMA and OBEREA, and the principal piece of Indian architecture 'in the iſland. It was a pile of ſtone-work, raiſed pyramidically, 'upon an oblong baſe, or ſquare, two hundred and ſixty-ſeven feet 'long, and eighty-ſeven feet wide. It was built like the ſmall pyramidal mounts upon which we ſometimes fix the pillar of a ſundial, where each ſide is a flight of ſteps. The ſteps, however, at 'the ſides, were broader than thoſe at the ends; ſo that it terminated

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 147.

'nated not in a ſquare of the ſame figure with the baſe, but in a ridge, 'like the roof of a houſe *.'

Theſe people have a cuſtom of anointing their heads with an oil expreſſed from the cocoa-nut, in which ſome ſweet herbs or flowers have been infuſed. As the oil is generally rancid, the ſmell is at firſt very offenſive; 'and,' Captain COOK remarks, 'as they live 'in a hot country, and have no ſuch thing as a comb, they are not 'able to keep their heads free from lice, which the children and com'mon people ſometimes pick out and eat: A hateful cuſtom, whol'ly different from their manners in every other particular; for they 'are delicate and cleanly almoſt without example; and thoſe to 'whom we diſtributed combs ſoon delivered themſelves from ver'min †.'

The cuſtom of *tattowing*, or ſtaining various parts of their bodies by means of ſmall punctures and a kind of lamp-black, is general here, as well as in many other parts of the world. But they ſeldom or never deform their faces with theſe marks. 'It is ſtrange,' Captain COOK remarks, 'that theſe people ſhould value themſelves upon 'what is no diſtinction; for I never ſaw a native of this iſland, ei'ther man or woman, in a ſtate of maturity, in whom theſe marks 'were wanting ‡.'—Their garments conſiſt of cloth, or matting, of various kinds. The cloth, which is a vegetable maſh, like our paper, they wear in dry weather only, becauſe it will not bear wetting; and the matting when it rains. Theſe garments are put on in many different faſhions according as fancy directs; for no part of their clothes is cut into ſhape, nor are any two pieces ſewed together. 'As 'finery,'

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 166.

† Ibid. p. 189. ‡ Ibid. p. 191.

‘ finery,’ Captain COOK remarks, ‘ is always troubleſome, and particularly in a hot country, where it conſiſts of putting one covering ‘ upon another, the women of rank always uncover themſelves as ‘ low as the waiſt in the evening, throwing off all that they wear on ‘ the upper part of the body, with the ſame negligence or eaſe as our ‘ ladies would lay by a cardinal or double handkerchief. And the ‘ chiefs, even when they viſited us, though they had as much cloth ‘ round their middle as would clothe a dozen people, had frequently ‘ the reſt of the body quite naked. Upon their legs and feet they ‘ wear no covering; but they ſhade their faces from the ſun ‘ with little bonnets, either of matting or of cocoa-nut leaves. ‘ This, however, is not all their head-dreſs: The women ſometimes ‘ wear little turbans, and ſometimes a dreſs which they value much ‘ more, and which, indeed, is much more becoming, called *Tomou*. ‘ The *Tomou* conſiſts of human hair; plaited in threads, ſcarcely ‘ thicker than ſewing ſilk. Mr BANKS has pieces of it above a mile ‘ in length without a knot. Theſe they wind round the head in ‘ ſuch a manner as produces a very pretty effect, and in a very great ‘ quantity; for I have ſeen five or ſix ſuch pieces wound about the ‘ head of one woman. Among theſe threads they ſtick flowers of various kinds *.’ The men likewiſe ornament their heads with the feathers of the Tropic-bird, and garlands of flowers. Beſide flowers, their perſonal ornaments are not numerous: Both ſexes wear ear-rings, but they are placed on one ſide only: ‘ When we came,’ ſays Captain COOK, ‘ they conſiſted of ſmall pieces of ſhell, ſtone, berries, ‘ red peas, or ſome ſmall pearls, three in a ſtring; but our beads ‘ very ſoon ſupplanted them all †. The children go perfectly naked;

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 192, &c.

† Ibid. p. 194.

'ked; the boys till they are ſix or ſeven years old, and the girls till 'they are three or four.'

In Otaheite, the houſes are all erected in the woods between the ſea and the mountains; and no more ground is cleared for each houſe than is ſufficient to prevent the dropping of the branches upon the thatch. Hence from their houſes the inhabitants ſtep immediately into the moſt delightful ſhades, formerly groves of bread-fruit and cocoa-nut trees, which are interſected, in all directions, by the paths that lead from one houſe to another. The ground which a houſe covers is generally a parallelogram of about twenty-four feet long, and eleven wide, over which a roof is raiſed upon three rows of poſts, parallel to each other, one on each ſide, and the other in the middle. This roof, which is thatched with palm-leaves, conſiſts of two flat ſides that terminate in a ridge, exactly ſimilar to the thatched houſes in Britain. The utmoſt height of the inſide is about nine feet, and the eaves on each ſide reach to about three feet and a half of the ground. 'Below this,' Captain COOK informs us, 'and 'through the whole height at each end, it is open, no part of it being incloſed with a wall.—The floor is covered, ſome inches deep, 'with ſoft hay. Over this are laid mats; ſo that the whole is one 'cuſhion, upon which they ſit in the day, and ſleep in the night. In 'ſome houſes, however, there is one ſtool, which is wholly appropriated to the maſter of the family. Beſides this, they have no 'furniture, except a few little blocks of wood, the upper ſide of 'which is hollowed into a curve, and which ſerve them for pillows*.'

Their houſes are principally employed as dormitories; for, except when it rains, they eat their victuals in the open air, under the ſhade of a neighbouring tree. ‘ The clothes that they wear in the day ‘ ſerve them for covering in the night ; the floor is the common bed ‘ of the whole houſehold, and is not divided by any partition. The ‘ maſter of the houſe and his wife ſleep in the middle, next to them ‘ the married people, next to them the unmarried women, and next to ‘ them, at a little diſtance, the unmarried men ; the ſervants, or ‘ *Toutous*, as they are called, ſleep in the open air, except it rains, ‘ and, in that caſe, they come juſt within the ſhed *.’ They have houſes, however, of a much larger ſize, built for the temporary accommodation of a whole diſtrict. Some of theſe are 200 feet long, 30 broad, and, under the ridge, 20 feet high. Theſe houſes are built and maintained at the common expence of the diſtrict †. ‘ Theſe ‘ houſes, like thoſe of ſeparate families, have no walls. Privacy, in‘deed, is little wanted among people who have not even the idea ‘ of indecency, either in words or actions ‡.’

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 195.

The chief food of the natives of Otaheite conſiſts of vegetables. They have no tame animals, except poultry, hogs, and dogs, and theſe are not numerous. Captain COOK and his aſſociates agreed that a South Sea dog was little inferior to a Britiſh lamb, which is probably occaſioned by their being kept up, and fed ſolely upon vegetables. The ſea affords them a great variety of fiſhes ; of which the ſmaller ones are generally eaten raw, as we eat oiſters. Their principal vegetable aliment is the bread-fruit, to obtain which it coſts them no other trouble than that of climbing a tree. The tree which produces this fruit does not, it is true, ſhoot up ſpontaneouſly : ‘ But,’ Captain COOK remarks, ‘ if a man plants ten of them in his ‘ lifetime

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 195.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 195.

† Ibid. p. 196.

‡ Ibid.

'lifetime, which he may do in about an hour, he will as completely fulfil his duty to his own and future generations, as the native of our leſs temperate climate can do by ploughing in the cold of winter, and reaping in the ſummer's heat, as often as theſe ſeaſons return.—It is true, indeed, that the bread-fruit is not always in ſeaſon; but cocoa-nuts, bananas, plantains, and a great variety of other fruits, ſupply the deficiency *.' Their art of cookery is very ſimple and limited. It conſiſts entirely of broiling and baking. Their drink, in general, is water, or the juice of the cocoa-nut, the art of producing intoxicating liquors by fermentation or diſtillation being happily unknown to them. Neither do they chew any narcotic ſubſtances, ſuch as opium, beetle-root, and tobacco. 'Some of them,' ſays Captain COOK, 'drank freely of our liquors, and, in a few inſtances, became very drunk; but the perſons to whom this happened were ſo far from deſiring to repeat the debauch, that they would never touch any of our liquors afterwards. We were, however, informed, that they became drunk by drinking a juice that is expreſſed from the leaves of a plant which they call *Ava Ava*. This vice is almoſt peculiar to the chiefs and conſiderable perſons, who vie with each other in drinking the greateſt number of draughts, each draught being about a pint †. They keep this intoxicating juice with great care from their women ‡.'

The quantity of food which theſe people eat at a meal is prodigious.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 197.

† A ſimilar practice was long prevalent in Scotland. When a lady's health was drunk to, if any gentleman in company ſaid *more*, the antagoniſts proceeded to double the quantity each time the word was repeated, till it terminated in one of them falling from his chair. This abſurd and hurtful amuſement has, for ſome years, happily ceaſed.

‡ Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 200.

gious. ‘ I have ſeen one man,’ ſays Captain COOK, ‘ devour two ‘ or three fiſhes as big as a perch ; three bread-fruits, each bigger ‘ than two fiſts ; fourteen or fifteen plantains or bananas, each of ‘ them ſix or ſeven inches long, and four or five round ; and near a ‘ quart of the pounded bread-fruit, which is as ſubſtantial as the ‘ thickeſt unbaked cuſtard *.

It is a ſingular cuſtom among the Otaheiteans, that, though fond of ſociety, and particularly that of their women, they always eat alone. ‘ How a meal,’ Captain COOK remarks, ‘ which every where ‘ elſe brings families and friends together, came to ſeparate them ‘ here, we often inquired, but could never learn. They eat alone, ‘ they ſaid, becauſe it was right ; but why it was right to eat alone, ‘ they never attempted to tell us. Such, however, was the force of ‘ habit, that they expreſſed the ſtrongeſt diſlike, and even diſguſt, at ‘ our eating in ſociety, eſpecially with our women, and of the ſame ‘ victuals. Even two brothers and two ſiſters have each their ſeparate baſkets with proviſion and the apparatus of their meal. When ‘ they firſt viſited us at our tents, each brought his baſket with him ; ‘ and, when we ſat down to table, they would go out, ſit down upon the ground, at two or three yards diſtance from each other, and, ‘ turning their faces different ways, take their repaſt without interchanging a ſingle word †.

Flutes and drums are their only muſical inſtruments. The flutes are made of hollow bamboos, and the drums of hollowed blocks of wood, of a cylindrical form, ſolid at one end, and, at the other, covered with a ſhark's ſkin. Theſe drums they beat with their

‘ hands,

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 202.

† Ibid. p. 203.

hands, and not with ſticks; and they know how to tune two drums of different notes into concord.

With regard to ſexes, the natives of Otaheite ſeem not to have even the ſenſe of modeſty. Among other amuſements, they have a dance, called *Timorodee*, which is performed by young girls. It conſiſts of motions and geſtures extremely wanton and diſſolute. Theſe people have aſcended a ſcale of ſenſuality unknown to every other nation whoſe manners have been recorded. ‘ A very conſi-‘ derable number of the people of Otaheite, of both ſexes,’ Captain Cook tells us, ‘ have formed themſelves into ſocieties, in which ‘ every woman is common to every man. Theſe ſocieties are diſ-‘ tinguiſhed by the name of *Arreoy*; and the members have meet-‘ ings, at which no other is preſent, where the men amuſe them-‘ ſelves by wreſtling, and the women, notwithſtanding their occa-‘ ſional connection with different men, dance the *Timorodee* in all ‘ its latitude, as an incitement to deſires which, it is ſaid, are fre-‘ quently gratified upon the ſpot. This, however, is comparatively ‘ nothing. If any of the women happen to be with child, which, ‘ in this manner of life, happens leſs frequently than if they were ‘ to cohabit only with one man, the poor infant is ſmothered the ‘ moment it is born, that it may be no incumbrance to the father, ‘ nor interrupt the mother in the pleaſures of her diabolical proſtitu-‘ tion. A practice ſo horrid,’ continues our author, ‘ ſhould not be ‘ imputed to human beings upon ſlight evidence; but I have ſuch as ‘ abundantly juſtifies me in the account I have given. The people ‘ themſelves are ſo far from concealing their connection with ſuch a ‘ ſociety as a diſgrace, that they boaſt of it as a privilege; and both ‘ myſelf and Mr Banks, when particular perſons have been pointed ‘ out to us as members of the Arreoy, have queſtioned them about it,

‘ and received the account that has been here given from their own ‘ lips. They have acknowledged, that they have long been mem‘ bers of this accurſed Society, that they belonged to it at that time, ‘ and that ſeveral of their children had been put to death *.

The natives of Otaheite are extremely attentive to perſonal cleanlineſs. Both ſexes uniformly bathe themſelves three times every day; as ſoon as they riſe in the morning, at noon, and before they go to ſleep at night. This operation they perform either in the ſea, or in ſome adjacent river.

Their chief *manufacture* is cloth, which conſiſts of three kinds, and is compoſed of the bark of three different trees, the Chineſe paper mulberry, the bread-fruit tree, and a tree which reſembles the wild fig-tree of the Weſt Indies. The cloth procured from the paper mulberry is the fineſt and whiteſt. This kind is chiefly worn by people of ſome diſtinction, and, when dyed red, takes a better colour. A ſecond kind, which is inferior both in whiteneſs and ſoftneſs, they make of the bread-fruit tree: It is worn chiefly by the lower claſs of people. A third ſort they derive from a tree that reſembles the fig. This cloth, though not ſo pleaſing to the eye or the touch, is the moſt valuable, becauſe it reſiſts the operation of water, which the other two ſpecies cannot. Theſe three uſeful trees, as might be expected, are propagated with care and diligence. The liber, or inner rind of the bark, is alone employed; and the operation of making the various kinds of cloth is performed by maſhing the ſubſtances in water, and beating them into form with bone-mallets. This ſpecies of manufacture, though different, is ſomewhat ſimilar to our making of paper *. Theſe cloths they dye with ſeveral colours, but chiefly red and yellow. Their dyes, or rather pigments, conſiſt of the expreſſed juices of various vegetables.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 207, &c.

Theſe people likewiſe manufacture matting of many different kinds; ſome of which are finer and better than any we have in Europe. The coarſer matting they ſleep upon, and the finer they wear as garments in wet weather. In making baſkets and wicker-work, they are alſo very ingenious and dexterous. 'Their baſkets,' ſays Captain COOK, 'are of a thouſand different patterns, many of them 'exceedingly neat; and the making them is an art that every one 'practiſes, both men and women †.' Of the bark of the *Poerou*, or *Hibiſcus tileaceus* of LINNAEUS, they make ropes and fiſhing lines, from the thickneſs of an inch to that of a packthread; with theſe they make nets for fiſhing. With thread made of the fibres of cocoa-nut, they faſten together the ſeveral parts of their canoes. 'Of the bark 'of the *Erowa*,' Captain COOK informs us, 'a kind of nettle which 'grows in the mountains, and is therefore rather ſcarce, they make 'the beſt fiſhing lines in the world: With theſe they hold the 'ſtrongeſt and moſt active fiſh, ſuch as Bonetas and Albicores, which 'would ſnap our ſtrongeſt ſilk lines in a minute, though they are 'twice as thick. They make alſo a kind of ſeine, of a coarſe broad 'graſs, the blades of which are like flags. Theſe they twiſt and tie 'together in a looſe manner, till the net, which is about as wide as 'a large ſack, is from ſixty to eighty fathoms long. This they haul 'in ſmooth ſhoal-water, and its own weight keeps it ſo cloſe to the 'ground that ſcarcely a ſingle fiſh can eſcape ‡.'

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* In the Muſaeum of the Antiquarian Society of Edinburgh, many ſpecimens of theſe cloths may be ſeen.

† Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 217.

‡ Ibid. p. 218.

Every fiſherman here is his own artificer, and makes hooks, lines, and even harpoons, with great neatneſs and ingenuity *. The chief materials of which they are compoſed, are wood, bones, and ſhells.

One great article in their manufacture is the building and carving their boats; and Captain COOK remarks, that to fabricate one of their principal veſſels, with their tools, is perhaps as great a work as to build a Britiſh man of war with ours. They employ an adze of bazaltic ſtone, a chiſſel, or gouge, of bone, a raſp of coral, and the ſkin of the ſting-ray, with coral ſand, as a file or poliſher. 'This,' ſays Captain COOK, 'is a complete catalogue of their tools; and with 'theſe they build houſes, conſtruct canoes, hew ſtone, and fell, 'cleave, carve, and poliſh timber †.' The length of their canoes vary from ten to ſeventy-two feet, according to the purpoſes they are intended to anſwer, and are diſtinguiſhed by different names. Their breadth is by no means proportioned to their length; for thoſe of ten feet are about a foot wide only, and thoſe which exceed ſeventy in length, are not more than two feet broad. Thoſe long veſſels never go to ſea ſingle, but two of them are faſtened together, ſide by ſide, at the diſtance of near three feet, by ſtrong rafters of wood, which are laid acroſs the canoes and laſhed to their gunwales. 'Upon theſe,' ſays Captain COOK, 'in the fore-part, a ſtage or platform is raiſed, about ten or twelve feet long, and ſomewhat wider 'than the boats, which is ſupported by pillars about ſix feet high: 'Upon this ſtage ſtand the fighting men, whoſe miſſile weapons are 'ſlings and ſpears; for, among other ſingularities in the manners of 'theſe people, their bows and arrows are uſed only for diverſion, as

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* Of theſe, various ſpecimens may be ſeen in the Muſaeum of the Antiquarian Society of Edinburgh.

† Hawkeſworth's Narrative, &c. vol. 2. p. 220.

'as we throw quoits. Below theſe ſtages ſit the rowers, who re-'ceive from them thoſe that are wounded, and furniſh freſh men to 'aſcend in their room *.' The oars or paddles employed to manage theſe boats have a long handle and a flat blade, not unlike a baker's peal. Some of them have one maſt, and ſome two; and, when the length of the canoe is thirty feet, that of the maſt is about five and twenty. The ſails conſiſt of ſtrong matting. With theſe boats the natives, in going from one iſland to another, are ſometimes out a month together. Sometimes, Captain COOK informs us, they are fourteen or twenty days at ſea, and could keep it longer, if they had more ſtowage for water and other proviſions. They have a wonderful ſagacity in foretelling the weather, eſpecially the quarter from which the wind ſhall blow at a future period.

'In their longer voyages,' ſays Captain COOK, 'they ſteer by 'the ſun in the day, and, in the night, by the ſtars; all of which 'they diſtinguiſh ſeparately by names, and know in what part of 'the heavens they will appear in any of the months during which 'they are viſible in their horizon. They alſo know the time of 'their annual appearing and diſappearing with more preciſion than 'will eaſily be believed by any European aſtronomer †.

With regard to the diviſion of time in Otaheite, Captain COOK and the other gentlemen were not able to acquire a perfect idea. They, however, remarked, that, when ſpeaking of time, either paſt or future, theſe people uniformly employed the word *Malama*, which ſignifies *Moon*. 'Of theſe moons,' ſays Captain COOK, 'they count thirteen, and then begin again; which is a demonſtra-'tion that they have a notion of the ſolar year ‡.' Every day, or twenty-four hours, they divide into twelve parts. During the day, they eſtimate theſe diviſions pretty accurately by the height of the ſun; but, when the ſun is below the horizon, few of them are capable of reckoning time by means of the ſtars. In numeration, they proceed from one to ten, which they count on the fingers of both hands. In counting above ten, they repeat the name of that number, and add the word *more;* as ten and one *more* is eleven; ten and two more is twelve, &c.; in the ſame manner as we ſay twenty-one, twenty-two. 'When they come to ten and ten more,' Captain COOK informs us, 'they have a new denomination, as we ſay a 'ſcore; and by theſe ſcores they count till they get ten of them, 'when they have a denomination for two hundred *; and we never 'could diſcover that they had any denomination to expreſs a greater 'number †.—In meaſuring diſtance, they are much more deficient 'than in computing numbers, having but one term, which anſwers 'to *fathom*. When they ſpeak of diſtances from place to place, 'they expreſs it, like the Aſiatics, by the time that is required to paſs 'it ‡.'

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* Hawkeſworth's Narrative, &c. vol. 2. p. 221.

† Ibid. p. 226.

‡ Ibid. p. 227.

The language of the Otaheiteans, we are informed, is ſoft and melodious. It abounds with vowels, and is eaſily pronounced. 'Whether it is copious,' Captain COOK remarks, 'we were not 'ſufficiently acquainted with it to know; but it is certainly very 'imperfect; for it is almoſt totally without inflection, both of nouns 'and verbs. Few of the nouns have more than one caſe, and few 'of the verbs more than one tenſe; yet we found no great difficulty in making ourſelves mutually underſtood ||.' In their language, however, they have a few adjuncts which are very uſeful to them,

but

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* Hawkeſworth's Narrative, &c. vol. 2. p. 228.

† Ibid.

‡ Ibid.

|| Ibid.

but extremely puzzling to ſtrangers. ‘ One aſks another,’ ſays Captain COOK, ‘ *Harre hea?* “ Where are you going?” The other ‘ anſwers, *Ivahinera*, “ To my wives;” upon which the firſt re- ‘ peating the anſwer interrogatively, “ To your wives?” is anſwered, ‘ *Ivahinereira;* “ Yes, I am going to my wives.” Here the ſuffixa ‘ *era* and *eira* ſave ſeveral words to both parties *.’

In general, the *languages* in the South Sea, and particularly in Otaheite, ſeem to conſiſt of ſounds which are extremely ſoft and delicate. The proportion of vowels employed greatly exceeds that of the conſonants; and it is not unworthy of remark, that, with regard to language, even in Europe, the nearer we approach to the equatorial regions, the number of vowels increaſe, and the languages become not only more perfect, by the inflexions of nouns and verbs, but more harmonious and muſical. The Italian is much more ſoft and ductile, and better accommodated to the purpoſes of poetry, than thoſe of their neighbours the French or Germans. The Greek, again, in theſe qualities, exceeds the Italian; and the Perſic, and other Aſiatic languages, are ſtill ſofter and more languiſhing than the Greek. In the South Sea iſlands, Captain COOK informs us, ‘ their language is ſoft and melodious; it abounds with vowels, and ‘ we eaſily learnt to pronounce it; but found it exceedingly difficult ‘ to teach them to pronounce a ſingle word of ours; probably not ‘ only from its abounding in conſonants, but from ſome peculiarity ‘ in its ſtructure; for Spaniſh and Italian words, if ending in a ‘ vowel, they pronounced with great facility †.’—To give ſome faint idea of their language, I ſhall ſubjoin a few examples of their common words: ‘ *Ahewh*, the noſe; *Roourou*, the hair; *Outou*, the ‘ mouth; *Niheo*, the teeth; *Meu-eumi*, the beard; *Tiarraboa*, the

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* Hawkeſworth's Narrative, &c. vol. 2. p. 229.

† Ibid. p. 228.

'throat; *Tuamo*, the ſhoulders; *Tuah*, the back; *Oama*, the breaſt; 'Oboo, the belly; *Rema*, the arm; *Mieu*, the nails; *Hoouhah*, the 'thighs; *Avia*, the legs; *Tapoa*, the feet; *Booa*, a hog; *Moa*, a 'fowl; *Euree*, a dog; *Ooroo*, bread-fruit; *Hearee*, cocoa-nuts; *Mia*, 'bananas; *Vaee*, wild plantains; *Poe*, beads; *Ahou*, a garment *,' &c.

Captain COOK and his aſſociates, with much attention and laudable induſtry, have publiſhed a pretty extenſive vocabulary, in alphabetical order, of the language ſpoken in ſeveral of the South Sea iſlands. They have likewiſe ſubjoined, in the form of an analogical table, ſpecimens of the languages employed in eight different iſlands; and the ſimilarities in the general ſtructure of theſe languages muſt ſurpriſe every reader, eſpecially when the great diſtances of many of theſe iſlands from each other are conſidered. I ſhall give a few examples: *A Bird*, in Otaheite, is *Manoo;* in Eaſter Iſland, *Manoo;* in the Iſland Amſterdam, *Manoo*; in Tanna, *Manoo;* in New Caledonia, *Manee*, or *Maneek*. In Otaheite, *One* is *A'Tahay;* in Eaſter Iſland, *Katta'haee;* in the Marqueſas Iſles, *Atta'haee;* in Amſterdam Iſland, *Ta'haee;* in Malicolo, *Tſee'kaee;* in Tanna, *Reedee;* in New Caledonia, *Wagee'aing*. *Two*, in Otaheite, is *E'rooa;* in Eaſter Iſland, *'Rooa;* in the Marqueſas Iſles, *A'ooa;* in Amſterdam Iſland, *E'ooa;* in Malicolo, *E'ry;* in Tanna, *'Karoo;* in New Caledonia, *'Waroo. Three*, in Otaheite, is *'Toroo;* in Eaſter Iſland, *'Toroo;* in the Marqueſas Iſles, *A'toroo;* in Amſterdam Iſland, *'Toroo;* in Malicolo, *E'rei;* in Tanna, *'Kabar;* in New Caledonia, *Watee'en*.

From the analogical ſpecimens of eight languages uſed in the South Sea iſlands, Captain COOK makes the following obſervations:

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* Hawkeſworth's Narrative, &c. vol. 2. p. 229.

‘ It may be eaſily perceived,’ ſays he, ‘ that, notwithſtanding ſome ‘ words are entirely different, the firſt five Indian languages are ‘ radically the ſame, though the diſtance from Eaſter Iſland to New ‘ Zealand is upwards of fifteen hundred leagues. The principal ‘ difference conſiſts in the mode of pronunciation, which, in Eaſter ‘ Iſland, Amſterdam, and New Zealand, is more harſh, or guttural, ‘ than at the Marqueſas Iſles, or Otaheite. The other three differ ‘ totally, not only from the preceding, but from each other; which ‘ is more extraordinary than the agreement of the others, as, from ‘ Malicolo to Tanna, you never loſe ſight of land; nor is New Ca‘ ledonia at a great diſtance from the laſt place. In the language of ‘ Malicolo, a great number of harſh labial ſounds prevail, very dif‘ ficult to be repreſented in writing. At Tanna, the pronunciation ‘ is likewiſe harſh, but rather guttural; and the inhabitants of New ‘ Caledonia have many naſal ſounds, or ſnivel much in ſpeaking. ‘ It may, however, be obſerved, that, in the three laſt languages, ‘ ſome words are found, which ſeem to have a diſtant reſemblance ‘ to thoſe that go before; as *Brrooas*, in Malicolo, and *'Booga*, or ‘ *Boogas*, in Tanna, both ſignifying a *hog;* which, at Otaheite and ‘ the Marqueſas, is expreſſed by the word *Böa*, and, at Amſterdam ‘ by *Boo'acka* *.’

With regard to *diſeaſes*, among a people whoſe food is ſo ſimple, and who are ſeldom intoxicated, their number, as might naturally be expected, is not great. ‘ The natives, however,’ Captain COOK informs us, ‘ are afflicted with the eryſipelas, and cutaneous erup‘ tions of the ſcaly kind, very nearly approaching to a leproſy.— ‘ We obſerved alſo a few who had ulcers upon different parts of

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* Cook's Voyage, vol. 2. p. 364. The accents at the beginning or in the middle of words denote the chief emphaſis on theſe ſyllables.

'their bodies, ſome of which had a very virulent appearance; yet 'they ſeemed not much to be regarded by thoſe who were afflicted 'with them; for they were left entirely without application even to 'keep off the flies *.' In theſe happy regions, where diſeaſes are neither numerous nor complicated, they have no profeſſional phyſicians. In Otaheite, the management of the ſick is entirely committed to the prieſts; and their method of cure conſiſts chiefly of ceremonies and prayers. 'When a prieſt,' ſays Captain COOK, 'viſits 'his patient, he repeats certain ſentences, which appear to be ſet 'forms contrived for the occaſion; and, at the ſame time, plaits 'the leaves of the cocoa-nut into different figures very neatly; ſome 'of theſe he faſtens to the fingers and toes of the ſick.—Theſe 'ceremonies are repeated till the patient recovers or dies. If he 'recovers, they ſay the *remedies cured him*; if he dies, they ſay the 'diſeaſe was *incurable*; in which, perhaps, they do not much differ 'from the *cuſtom* of other countries †.—If we had judged of their 'ſkill in ſurgery from the dreadful ſcars which we ſometimes ſaw, 'we ſhould have ſuppoſed it to be much ſuperior to the art not only 'of their phyſicians, but of ours. We ſaw one man whoſe face 'was almoſt entirely deſtroyed; his noſe, including the bone, was 'perfectly flat; and one cheek and one eye were ſo beaten in, that 'the hollow would almoſt receive a man's fiſt, yet no ulcer re'mained ‡.'

It is painful to learn, that the intercourſe of theſe once happy and healthy people with what we call *refined* Europeans, ſhould have entailed upon them, perhaps for ever, that dreadful ſcourge the *venereal* diſeaſe! 'As it is certain,' Captain COOK remarks ‖,

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* Hawkeſworth's Narrative, &c. vol. 2. p. 231.

† Ibid.

‡ Ibid. p. 232.

‖ Ibid.

‘ that no European veſſel beſides our own, except the Dolphin, ‘ and the two that were under the command of Monſ. **Bougainville**, ever viſited this iſland, it muſt have been brought either ‘ by one of them, or by us. That it was not brought by the Dolphin, Captain **Wallis** has demonſtrated in the account of her ‘ voyage *; and nothing is more certain than that, when we arrived, it had made moſt dreadful ravages in the iſland. One of our ‘ people contracted it within five days after we went on ſhore; and, ‘ by the inquiries among the natives, which this occaſioned, we ‘ learnt, when we came to underſtand a little of their language, that ‘ it had been brought by the veſſels which had been there about ‘ fifteen months before us. They diſtinguiſhed it by a name of the ‘ ſame import with *rottenneſs*, but of a more extenſive ſignification; ‘ and deſcribed, in the moſt pathetic terms, the ſufferings of the firſt ‘ victims to its rage; and told us, that it cauſed the hair and the ‘ nails to fall off, and the fleſh to rot from the bones; that it ſpread ‘ a univerſal terror and conſternation among them, ſo that the ſick ‘ were abandoned by their neareſt relations, leſt the calamity ſhould ‘ ſpread by contagion, and left to periſh alone in ſuch miſery, as till ‘ then had never been known among them.’ A moſt diabolical compliment, from whatever nation it was imported, to a beautiful, an unſuſpicious, and, in a great meaſure, primatively innocent people. Such are the happy fruits of commerce! The *Arabians* gave us the *ſmall-pox*, and the *Americans* the *great*. Thus the extenſion of knowledge, by travelling and navigation, though highly acceptable to every human mind, is often productive of the moſt calamitous and deleterious effects. What are the devaſtations of war, and even of the peſtilence, when compared to the havoc daily occaſioned by theſe two accurſed diſeaſes?

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* Vol. 1. p. 489. 490.

It is no ſmall conſolation, however, to be informed by Captain COOK, that there was ſome reaſon to hope, that the natives had diſcovered a ſpecific cure for the venereal diſeaſe; for, he remarks, during their ſtay upon the iſland, they ſaw none in whom it had made great progreſs. But the few following lines exhibit a moſt dreadful picture of the condition of theſe now unhappy people. 'We endeavoured to learn,' ſays Captain COOK, 'the medical qualities which they imputed to their plants; but our knowledge of 'their language was too imperfect for us to ſucceed. If we could 'have learnt their ſpecific for the venereal diſeaſe, if ſuch they have, 'it would have been of great advantage to us; for, when we left 'the iſland, it had been contracted by *more than half* the people on 'board the ſhip *.'

With regard to the *religion* of theſe people, Captain COOK remarks, it was difficult to acquire any clear and conſiſtent ideas. Like the religion of moſt other countries, it ſeemed to be involved in myſtery, and perplexed with inconſiſtencies. The idea of multiplication includes the intercourſe of two perſons; and, from the conjunction of two perſons, theſe people imagine every being in the univerſe to have originally proceeded. 'The ſupreme Deity,' Captain COOK remarks, 'one of thoſe two firſt beings, they call *Taroatai-'hetoomoo;* and the other, whom they ſuppoſe to have been a rock, '*Tepapa*. A daughter of theſe was *Tettowmatatayo*, the year, or 'thirteen months collectively, which they never name but upon this 'occaſion; and ſhe, by the common father, produced the months; 'and the months, by conjunction with each other, the days. The 'ſtars they ſuppoſe partly to be the immediate offspring of the firſt 'pair, and partly to have increaſed among themſelves; and they

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* Hawkeſworth's Narrative, &c. vol. 2. p. 233.

'have the ſame notion with reſpect to the different ſpecies of plants. 'Among other progeny of *Taroataihetoomoo* and Tepapa, they ſuppoſe an inferior race of deities, whom they call *Eatuas*.'

They tell us, that two of theſe Eatuas, at a remote period, inhabited the earth, and produced the firſt man, who, being ſtimulated to propagate his kind, and having no female but his own mother, with her he begot daughters, and by theſe daughters he had other daughters for ſeveral generations, before he had a ſon. A ſon, however, at laſt made his appearance, and he, by means of his ſiſters, peopled the earth *. This ſon they called *Tane*. Taroataihetoomoo, or the ſupreme Deity, is emphatically ſtiled the great cauſer of earthquakes: But the prayers of theſe people are commonly addreſſed to *Tane*, who is ſuppoſed to take a greater intereſt in the affairs of men. Their Eatuas, or ſubordinate deities, are numerous, and ſuppoſed to be of both ſexes. The males are worſhipped by the men, and the females by the women.

Theſe people believe the immortality of the ſoul, or, at leaſt, its exiſtence in a ſtate ſeparate from the body, and that, after death, there are two ſituations ſimilar to our heaven and hell. 'The ſuperior ſituation they call *Tavirua l'erai*, and the other *Tiahoboo*. They 'do not, however, conſider them as places of reward and puniſhment, but as receptacles for different claſſes; the firſt, for their 'chiefs and principal people, the other, for thoſe of inferior rank; 'for they do not ſuppoſe, that their actions here in the leaſt influence their future ſtate, or indeed that they come under the cognizance of their deities at all †.'

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* Theſe ideas muſt recall to every perſon's remembrance the ſtory of *Lot* and his *daughters*.

† Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 239.

The office of prieſt, or *Tahowa*, is hereditary. The claſs is numerous, and conſiſts of all ranks. Their chief prieſt, however, is commonly the younger brother of ſome reſpectable family, and revered next to their kings. As in all ignorant countries, the prieſts of Otaheite actually poſſeſs, or pretend to poſſeſs, ſuperior knowledge; but it conſiſts chiefly in their acquaintance with the ranks and names of the various Eatuas, or ſubordinate divinities, and their opinions concerning the origin of the world and of its productions, which have been preſerved traditionally among their order: But, what is of greater conſequence, the prieſts excel the reſt of the people in the knowledge of aſtronomy and navigation; and, in their language, the name *Tahowa* denotes nothing more than a man of knowledge. There are prieſts of every claſs; but they officiate only among the reſpective claſſes to which each belongs.

In this iſland, *marriage* ſeems to be nothing more than a ſimple agreement between the man and the woman, without the intervention of any prieſt. Though the prieſts, however, receive no money for nuptial benedictions, they have appropriated two operations, the one *tattowing*, and the other *circumciſion*, from which they derive conſiderable advantages, though they appear not to have any connection with religion. 'Circumciſion,' Captain COOK remarks, 'has been 'adopted merely from motives of cleanlineſs. It cannot, indeed, pro'perly be called *circumciſion*, becauſe the prepuce is not mutilated by 'a circular wound, but only ſlit through the upper part, to prevent 'its contracting over the *glans*. As neither of theſe can be perform'ed but by a prieſt, and as to be without either is the greateſt diſ'grace, they may be conſidered as a claim to ſurplice fees, like our 'marriages and chriſtenings [*].' It does not appear, however, that theſe

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[*] Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 241.

theſe people are idolaters; for they neither worſhip any thing made by their own hands, nor any viſible part of the creation. But the Indian approaches his Morai, or place of worſhip, 'with a reverence 'and humility,' Captain COOK remarks, 'that diſgraces the Chriſ'tian, not becauſe he holds any thing ſacred that is there, but be'cauſe he there worſhips an inviſible divinity, for whom, though he 'neither hopes for reward nor fears puniſhment, at his hand, he al'ways expreſſes the profoundeſt homage and moſt humble adora'tion *.'

With regard to *government*, Captain COOK informs us, that though he could not aſſert that they had any regular form ſimilar to our eſtabliſhment; 'yet,' ſays he, 'a ſubordination is eſtabliſhed 'among them, that greatly reſembles the early ſtate of every nation 'in Europe under the feudal ſyſtem, which ſecured liberty in the 'moſt licentious exceſs to a few, and entailed the moſt abject ſla'very upon the reſt †.' Their chief orders, or claſſes, are *Earee rahie*, or King; *Earee*, Baron; *Manahouni*, vaſſal; and *Toutou*, villain. In the iſland, there are two *Earee rabies*; one is ſovereign of one of the peninſulas, and the other of the ſecond, of which their whole territory conſiſts. Theſe Kings are treated with the higheſt reſpect. The Earees are Lords or Chiefs of one or more of the diſtricts into which the peninſulas are divided; and there ſeemed to be about one hundred of them in the whole iſland. They parcel out their territories to the Manahounies, who cultivate the portions which they hold under the Barons. The *Toutous*, or loweſt claſs, perform all the ſervile offices, as the villains did in feudal governments: 'Theſe,' ſays Captain COOK, 'do all the laborious 'work; they cultivate the land under the Manahounies, who are

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 241.

† Ibid. p. 242.

'only nominal cultivators for the lord; they fetch wood and water, 'and, under the direction of the miſtreſs of the family, dreſs the victuals; they alſo catch the fiſh *.'

The Earees keep a kind of courts, and have a number of attendants. The court of TOOTAHAH was the moſt ſplendid, becauſe he adminiſtered the government for his nephew, OUTOU, who was Earee rahie of Obereonoo. Captain COOK remarks a ſingular law, or cuſtom, among theſe people. 'The child of the Baron, or Earee,' he tells us, 'as well as of the ſovereign, or Earee rahie, ſucceeds to the 'title and honours of the father as ſoon as it is born: So that a baron, who was yeſterday called *Earee*, and was approached with the 'ceremony of lowering the garments, ſo as to uncover the upper part 'of the body, is to-day, if his wife was laſt night delivered of a 'child, reduced to the rank of a private man, all marks of reſpect 'being transferred to the child, if it is ſuffered to live, though the father ſtill continues poſſeſſor and adminiſtrator of his eſtate †.'

With regard to *war*, if a general attack is apprehended to be made upon the iſland, every diſtrict is obliged to furniſh its proportion of fighting men. Upon ſuch critical occaſions, the united forces of the iſland are commanded by the Earee rahie. Their principal weapons are ſlings, in the uſe of which they are very dexterous, pikes headed with the ſtings of the ſting-ray fiſh, and clubs ſix or ſeven feet in length, made of a very hard and compact wood. 'Thus armed,' Captain COOK remarks, 'they are ſaid to fight with great obſtinacy, 'which is the more likely to be true, as it is certain, that they give no 'quarter to either man, woman, or child, who is ſo unfortunate as 'to fall into their hands during the battle, or for ſome hours afterwards,

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 243.

† Ibid. p. 244.

'wards, till their paſſion, which is always violent, has ſubſided. 'The Earee rahie of Obereonoo, while we were here, was in per'fect amity with the Earee rahie of Tiârreboo, the other peninſula*.'

Captain COOK farther remarks, that, in a government ſo rude, it is not to be expected that diſtributive juſtice ſhould be regularly adminiſtered; that, where there is ſo little oppoſition of intereſts, owing to the facility with which all the paſſions and appetites of theſe people are gratified, few crimes can exiſt; that they have nothing reſembling money; that there is no permanent good which either fraud or force can obtain; that, when all the crimes committed in civilized nations, in order to procure money, are removed, few will remain; that, by TUPIA's information, we learnt, that both theft and adultery are ſometimes committed; that in all caſes where injuries have been ſuſtained, the ſufferer, if he is able, puniſhes the offender; that adultery is ſometimes, in the firſt ardour of reſentment, puniſhed with death; but that, without circumſtances of immediate provocation, the female generally ſuffers no more than a beating. 'As pu'niſhment, however,' ſays Captain COOK, 'is enforced by no law, 'nor taken into the hand of any magiſtrate, it is not often inflicted, 'except the injured party is the ſtrongeſt; though the chiefs do 'ſometimes puniſh their immediate dependents, for faults committed 'againſt each other, and even the dependents of others, if they are 'accuſed of any offence committed in their diſtrict †.'

From Otaheite, Captain COOK proceeded to another iſland, called *Huaheine*, which lies in the latitude of 16°. 43′ S. and longitude 150° 52′ W. from Greenwich. It is about ſeven leagues in circuit. The natives of this iſland are, in general, larger and ſtronger than thoſe of Otaheite. Mr BANKS meaſured one of the men, and found him to be ſix feet three inches and an half high. Theſe people, however, notwithſtanding their ſtrength and ſtature, like moſt ſavages, are extremely lazy. Mr BANKS could not perſuade any of them to go up the hills with him; becauſe, they ſaid, the fatigue would kill them. The women here are fairer and more handſome than thoſe of Otaheite. Mr BANKS's attention was much excited by a ſingular object: 'It was,' he remarks, 'a kind of cheſt or ark, the lid of which 'was nicely ſewed on, and thatched very neatly with palm-nut 'leaves. It was fixed upon two poles, and ſupported by little arches 'of wood, very neatly carved. The uſe of the poles ſeemed to be 'to remove it from place to place, in the manner of our ſedan-'chairs.—The firſt time Mr BANKS ſaw this coffer, the aperture at 'the end was ſtopped with a piece of cloth, which, leſt he ſhould 'give offence, he left untouched. The general reſemblance between 'this repoſitory and the *Ark of the Lord* among the Jews is re-'markable; but it is ſtill more remarkable, that, upon inquiring of 'TUPIA's boy TAYETO what it was called, he ſaid *Ewharre no 'Eatua*, the *houſe of the God*. He could, however, give no account 'of its ſignification or uſe [*].'

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 244.

† Ibid. p. 245.

After ſtaying ſome time on this iſland, Captain COOK made ſail for a neighbouring iſland called *Uliſtea*, which lies about ſeven or or eight leagues nearly ſouth-weſt from Huaheine. As ſoon as the ſhip came to an anchor, the natives came off in two canoes, each of which brought a woman and a pig. The women were ſuppoſed to be marks of confidence and friendſhip, and the pigs were intended as preſents. Both were received with proper acknowledgments;

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[*] Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 252.

and the ladies were complimented with a ſpike-nail and ſome beads. After the gentlemen landed, they examined a great Morai, called *Tapodeboatea*, and found it to differ much from thoſe of *Otaheite*; it conſiſted of four walls about eight feet high, and compoſed of coral ſtones, ſome of which were of a great ſize. This fabric incloſed an area of about twenty-five yards ſquare, and was filled up with ſmaller ſtones: 'Upon the top of it,' ſays Captain COOK, 'many planks 'were ſet up on an end, which were carved in their whole length. 'At a little diſtance, we found an altar, or *Ewhatta*, upon which lay 'the laſt oblation or ſacrifice, a hog of about eighty pounds weight, 'which had been offered whole, and very nicely roaſted. Here were 'alſo four or five *Ewharre no Eatua*, or houſes of God *, to which 'carriage poles were fitted, like that which we had ſeen at Huaheine. 'From hence we went to a long houſe, where, among rolls of cloth, 'and ſeveral other things, we ſaw the model of a canoe, about three 'feet long, to which were tied eight human jaw-bones. We had 'already learnt that theſe, like ſcalps among the Indians of North 'America, were trophies of war.'

Captain COOK, in his progreſs ſouthward, caſt anchor in another harbour of the ſame iſland. When the gentlemen landed, they were followed every where by men, women, and children, who ſhowed them every kind of civility. They were conducted to the houſes of the principal people, who received them in a very uncommon manner. 'The people who followed them while they were in their 'way,' Captain Cook informs us, 'ruſhed forward as ſoon as they 'came to a houſe, and went haſtily in before them, leaving however 'a lane ſufficiently wide for them to paſs. When they entered, they 'found thoſe who had preceded them ranged on each ſide of a long

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* Theſe arks, or houſes of God, are very frequent in the South Sea iſlands.

'mat, which was ſpread upon the ground, and at the farther end of 'which ſat the family. In the firſt houſe they entered they found 'ſome very young women or children, dreſſed with the utmoſt 'neatneſs.—One of them was a girl about ſix years old; her gown, 'or upper garment, was red; a large quantity of plaited hair was 'wound round her head, the ornament to which they give the name 'of *Tamou*, and which they value more than any thing they poſſeſs. 'She ſat at the upper end of a mat thirty feet long.—Our gentle'men walked up to her; and, as ſoon as they approached, ſhe 'ſtretched out her hand to receive the beads which they offered 'her, and no Princeſs in Europe could have done it with a better 'grace *.'

In the courſe of their walk, Captain COOK tells us, they met with a company of dancers, who afforded them great entertainment. The company conſiſted of two women, ſix men, and three drummers. Though they are continually going about, like the companies of Otaheite, they receive no gratuities from the ſpectators. The women wore upon their heads a conſiderable quantity of plaited hair, which was twiſted ſeveral times round, and adorned with the flowers of the Cape jeſſamine, which were arranged with great taſte, and formed a head-dreſs truly elegant. 'Their necks, ſhoul'ders, and arms,' ſays Captain COOK, 'were naked; ſo were the 'breaſts alſo as low as the parting of the arm; below that they 'were covered with black cloth, which ſet cloſe to the body; at the 'ſide of each breaſt, next the arm, was placed a ſmall plume of 'black feathers, much in the ſame manner as our ladies now wear 'their noſegays or *bouquets;* upon their hips reſted a quantity of 'cloth, plaited very full, which reached up to the breaſt, and fell 'down

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 263.

'down below into long petticoats, which quite concealed their feet, 'and which they managed with as much dexterity as our opera-'dancers could have done. The plaits above the waiſt were brown 'and white alternately; the petticoats below were all white. In 'this dreſs they advanced ſideways in a meaſured ſtep, keeping ex-'cellent time to the drums, which beat briſkly and loud.' They threw their bodies into poſtures, 'ſometimes ſtanding, ſometimes 'ſitting, and ſometimes reſting on their knees and elbows, the fin-'gers alſo being moved at the ſame time with a quickneſs ſcarcely 'to be imagined. Much of the dexterity of the dancers, however, 'and the entertainment of the ſpectators, conſiſted in the wanton-'neſs of their attitudes and geſtures, which was, indeed, ſuch as ex-'ceeds all deſcription *.' The men, between the dances of the women, performed a kind of dramatic interlude, which conſiſted of dialogue as well as dancing. On the following day, ſome of the gentlemen ſaw a more regular entertainment of the dramatic kind, which was divided into four acts †.

On the 5th day of Auguſt 1769, Captain Cook received from Opoony, the formidable King of Bolabola, a preſent of three hogs, ſome fowls, ſeveral large pieces of cloth fifty yards in length, and a conſiderable quantity of plantains, cocoa-nuts, and other comfortable refreſhments. The King likewiſe ſent a meſſage, that he was upon the iſland, and intended to wait upon Captain Cook the next day, at his ſhip. During the forenoon of the next day, the expected viſit of the great King was not performed. 'In the afternoon,' Captain Cook tells us, 'as the great King would not come to us, 'we were determined to go to the great King. As he was lord of 'the Bolabola men, the conquerors of this, and the terror of all the 'other

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[*] Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 264.

[†] Ibid. p. 266.

'other iſlands, we expected to ſee a chief young and vigorous, with 'an intelligent countenance, and an interpriſing ſpirit. We found, 'however, a poor feeble wretch, withered and decrepit, and half 'blind with age.—He did not receive us ſitting, or with any ſtate 'or formality, as the other chiefs had done. We made him our 'preſent, which he accepted, and gave a hog in return. We learnt 'that his principal reſidence was at Otaha; and, upon our telling 'him that we intended to go thither in our boats the next morning, 'and that we ſhould be glad to have him along with us, he pro'miſed to be of the party *.' In their way, they waited upon OPOONY the King, who was in his canoe, and ready to join them. When they landed at Otaha, they made him a preſent of an ax, with a view to induce him to encourage his ſubjects to bring proviſions. But the attempt was abortive; for they could not procure a ſingle article.

After leaving Otaha, in a few days, they met with another iſland, called *Obeteroa*. The boat was ſent to reconnoitre the ſhore. A number of the natives made their appearance; but they were all armed with lances and clubs, which, as a mark of defiance, they brandiſhed continually. A few of them made ſeveral attempts to board the boat and ſeize her; but all their attempts were abortive. When the boat got round a certain point of land in queſt of anchorage, it was perceived that all her hoſtile followers had deſiſted from the purſuit. After turning this point, the boat got into a large bay, at the bottom of which another body of men appeared, who were likewiſe armed with long lances. The boat puſhed toward the ſhore, in order to land; a canoe, at the ſame time, put off to meet them. They called out to the people in the canoe, that they were friends, and

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 268.

and would give them nails, which were exhibited to them. 'After 'ſome heſitation,' Captain COOK tells us, 'they came up to the 'boat's ſtern, and took ſome nails that were offered them with great 'ſeeming ſatisfaction; but, in leſs than a minute, they appeared to 'have formed a deſign of boarding the boat, and making her their 'prize. Three of them ſuddenly leaped into it, and the others 'brought up the canoe, which the motion in quitting her had 'thrown off a little, manifeſtly with a deſign to follow their aſſo-'ciates, and ſupport them in their attempt. The firſt that boarded 'the boat, entered cloſe to Mr BANKS, and inſtantly ſnatched his 'powder-horn out of his pocket. Mr BANKS ſeized it, and with 'ſome difficulty wrenched it out of his hand *.' The officer then ordered two guns to be diſcharged over their heads, upon which the whole of them inſtantly leaped into the water. After ſeveral fruitleſs attempts to trade and get proviſions from theſe people, and after, by means of the ſhip and boats, having circumnavigated the iſland, the want of harbours and of anchorage, and the hoſtile diſpoſitions of the people, determined Captain COOK to leave it. This iſland is ſituated in the latitude of 22°. 27′ S. and in the longitude of 150° 47′ W. from the meridian of Greenwich. The natives ſeemed to be luſty and well-made. Their arms were lances of about twenty feet in length, made of the Etoa wood, which is very hard, and ſharpened at the point. They had likewiſe a weapon, made of the ſame wood, which anſwered the double purpoſes of club and lance. This inſtrument of deſtruction was about ſeven feet long. As a guard againſt theſe weapons, the natives, when they attack each other, defend themſelves by many folds of mats wrapped round their bodies.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 274.

From the iſland of Oheteroa, Captain COOK ſailed to New Zealand, where, in a bay called *Tolaga*, they found excellent wood and water; and the diſpoſitions of the natives were friendly and obliging. In their bonatizing walks, Mr BANKS and Dr SOLANDER met with many houſes in the vallies which ſeemed to be entirely deſerted. The people live on the ridges of hills in a kind of ſlight ſheds. ‘As they were advancing,’ Captain COOK remarks, ‘in one of theſe vallies, the hills on each ſide of which were very ſteep, they were ſuddenly ſtruck with the ſight of a very extraordinary natural curioſity. It was a rock, perforated through its whole ſubſtance, ſo as to form a rude but ſtupendous arch or cavern, opening directly to the ſea. This aperture was ſeventy-five feet long, twenty-ſeven broad, and five and forty high, commanding a view of the bay and the hills on the other ſide, which were ſeen through it, and, opening at once upon the view, produced an effect far ſuperior to any of the contrivances of art[*].’

With regard to *ſtature*, the men of New Zealand are equal to the largeſt of thoſe in Europe. They are ſtrong and well limbed, but not fat, like the luxurious natives of the South Sea iſlands. They are extremely active, vigorous, and expert in all their operations and exertions. Their colour, in general, is not more brown than that of a Spaniard, who has been expoſed to the ſun. The appearance of their women is not remarkable for female delicacy, but their voices are ſoft and agreeable; and by this circumſtance, as the dreſſes of both ſexes are the ſame, the females are chiefly diſtinguiſhed. Their hair, in general, is black. Their teeth are very regular, and as white as ivory. In both ſexes, the features are agreeable. They ſeem to enjoy high health; and ſome of them had the appearance of great age. Their diſpoſitions are mild and gentle, and they diſcover the moſt tender affection for each other. They are, notwithſtanding, implacable to their enemies, to whom they never give quarter, but always *eat* them. For this horrid practice, Captain COOK, though with reluctance, inſinuates, as ſome kind of an apology, that the natives, when their crops of fern-root, yams, and potatoes fail, and when fiſh, in particular ſeaſons, cannot be had in ſufficient quantity, they often ſuffer the moſt dreadful pangs of hunger, and are not unfrequently in danger of periſhing by famine.

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[*] Hawkeſworth's Narrative of Cook's Voyage, vol. 2. p. 317.

'The ſituation and circumſtances, however, of theſe poor people,' Captain COOK remarks, 'as well as their temper, are favourable to 'thoſe who ſhall ſettle as a colony among them. Their ſituation 'ſets them in need of protection, and their temper renders it eaſy 'to attach them by kindneſs; and, whatever may be ſaid in favour 'of a ſavage life, among people who live in luxurious idleneſs upon 'the bounty of Nature, civilization would certainly be a bleſſing to 'thoſe whom her parſimony ſcarcely furniſhes with the bread of 'life, and who are perpetually *deſtroying* each other by violence, as 'the only alternative of periſhing by hunger[*].

When Captain COOK firſt landed upon their coaſt, theſe people, who are habitually inured to war, and conſider every ſtranger as an enemy, were always diſpoſed to make hoſtile attacks, and to ſteal, till they were taught the deſtructive effects of fire-arms. But, after being convinced, that ſuperiority of power by no means conſiſted in numbers alone, they became both friendly and hoſpitable, and exhibited the moſt unbounded confidence in their unknown viſitors. Both ſexes mark their faces and bodies with black ſtains, called *Amoco*, ſimilar to the tattowing in Otaheite. The men, particularly, add new ſtains every year; ſo that, in an advanced period of life, they are almoſt covered from head to foot. 'Beſides the Amoco,' ſays Captain COOK, 'they have marks impreſſed by a method unknown 'to us, of a very extraordinary kind. They are furrows of about a line 'deep, and a line broad, ſuch as appear upon the bark of a tree which 'has been cut through, after a year's growth. The edges of theſe 'furrows are afterwards indented by the ſame method, and, being 'perfectly black, they make a moſt frightful appearance *.' The faces of the old men are almoſt totally covered with theſe marks. Thoſe who are very young, like the women, black only their lips; but, as they grow old, they gradually increaſe theſe ſuppoſed ornaments. The lines upon the face are generally ſpirals, and are drawn with great dexterity and elegance; for the marks on one ſide correſpond exactly with thoſe on the other. The marks on the body have ſome reſemblance to the foliage in old chaſed ornaments, and the convolutions of fillagra-work, in which they exhibit a great luxuriance of fancy. Beſides, theſe people not only dye, but paint their ſkins with red oker. The dreſs of a New Zealander has an uncouth appearance. It conſiſts of the leaves of the flag, ſplit into two or three ſlips. When dry, the ſlips are interwoven with each other, and form a kind of ſtuff between netting and cloth. Of two pieces of this cloth they make a complete dreſs; one of them is tied over the ſhoulders, and reaches as low as the knees; and the other piece is wrapped round the waiſt, and reaches nearly to the ground. Beſide this coarſe flag, they make two ſorts of cloth with a ſmooth ſurface, and very ingeniouſly manufactured. One ſort reſembles our canvas, but is much ſtronger. The other kind is formed by many threads lying very cloſe one way; and a few croſs them the other, with

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[*] Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 449.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 452.

with a view to bind them together. But theſe laſt are about half an inch aſunder, reſembling thoſe round pieces of cane matting occaſionally placed under the diſhes of our tables. Both theſe kinds of cloth they ornament with neat ſtitched borders of various colours and patterns, not unlike thoſe made uſe of in the ſamplars which our young girls work when at ſchool. But the ornament they eſteem the moſt conſiſts of ſtripes of their dogs fur, placed at conſiderable diſtances from each other. Inſtead of fur, the red feathers of the parrot are ſometimes employed.

In New Zealand, the women, contrary to the general diſpoſition of the ſex, ſeemed not to be ſo fond of finery as the men. They did not adorn their heads with feathers. Their garments were made in the ſame form, and of the ſame materials as thoſe of the men.

Both ſexes bore their ears. They gradually ſtretch the holes till they are ſo large as to admit a finger. Into theſe holes they put different kinds of ornaments, ſuch as feathers, coloured cloth, bones of birds, and ſometimes a twig of wood. Into the ſame receptacles they commonly put the nails they received from the ſhips. The down of the albatroſs, which is as white as ſnow, the women thruſt through theſe holes. This down, when before and behind the hole in a bunch about the ſize of a fiſt, exhibits, we are told, a very ſingular, but not a diſagreeable appearance. ‘ Beſides the ornaments,’ ſays Captain Cook, ‘ that are thruſt through the ears, many others ‘ are ſuſpended to them by ſtrings; ſuch as chiſſels or bodkins ‘ made of green talc, upon which they ſet a high value; the nails ‘ and teeth of their deceaſed relations, the teeth of dogs, and every ‘ thing elſe that they can get, which they think either curious or ‘ valuable. The women alſo wear bracelets and anclets, made of

‘ the bones of birds, ſhells, or any other ſubſtances which they can ‘ perforate and ſtring upon a thread. The men ſometimes hanging ‘ to a ſtring, which went round the neck, a piece of green talc, or ‘ whalebone, ſomewhat in the ſhape of a tongue, with the rude figure of a man carved upon it; and upon this ornament they ſet a ‘ high value *.’

Their houſes, Captain COOK informs us, are very inartificial, hardly equalling, except in ſize, a dog-kennel. They ſeldom exceed eighteen or twenty feet in length, eight or ten in breadth, and five or ſix in height, from the pole that forms the ridge, to the ground. The framing is made of wood; and both walls and roof conſiſt of dried graſs very cloſely ſtuffed together. Some of their houſes are likewiſe lined with the bark of trees, which gives the inhabitants a very comfortable retreat. The roofs ſlope, like thoſe of our barns. The door, or rather hole, is at one end of the edifice, and is no higher than to admit a perſon creeping on his hands and knees.

The *furniture* of their houſes conſiſts of very few articles; for one cheſt generally contains the whole, if we except their proviſion-baſkets, the gourds which contain their freſh-water, and the hamoners employed in beating their fern-roots. Some rude tools, their clothes, and feathers to ſtick in their hair, compoſe the reſt of their treaſure.

Poſſeſſing no veſſel capable of boiling water, their *cookery* is wholly confined to baking and roaſting, which are performed nearly in the ſame manner as by the natives of the South Sea iſlands.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 457

Theſe people are extremely ingenious in the conſtruction of their *canoes.* The larger kind, which are often ſixty-eight feet long, five feet broad, and three feet and an half deep, are chiefly employed in war. Of armed men, they will carry eighty or even an hundred. The head and ſtern of theſe canoes are ornamented with carved work of various kinds, ſome of which are not inelegant, and others have a moſt groteſque appearance. The head and ſtern of their ſmaller canoes, whoſe chief deſtination is for fiſhing, are ornamented with the figure of a man, whoſe face is ugly in the extreme, with a monſtrous tongue lolling out of his mouth; and the eyes are compoſed of the white ſhells of ſea-ears.

With regard to the *tools* employed in fabricating their different pieces of workmanſhip; they conſiſt of adzes, axes, and chiſſels, which laſt they likewiſe uſe as augres for perforating or making holes in particular ſubſtances. Having no metals, or at leaſt not knowing how to extract them from their reſpective ores, their adzes and axes are made of a hard black ſtone, or of a green talc, which has the properties both of hardneſs and toughneſs; and their chiſſels of human bones, or ſmall fragments of jaſpar.

As to *civil government*, Captain COOK and the other gentlemen could procure little information. They, however, diſcovered, that, in this part of the iſland, the natives acknowledged one Chief, or King, whoſe name was *TERATU*. His territory, as an Indian monarch, is extenſive; for, Captain COOK remarks, he was acknowledged from Cape Kidnappers to the north; and weſt as far as the Bay of Plenty, a length of coaſt upwards of eighty leagues *. In the dominions of TEKATU, there are ſeveral ſubordinate chiefs, who were held in great veneration, and who probably were the adminiſtrators of juſtice: 'For,' ſays Captain COOK, 'upon our complaint 'to one of them, of a theft that had been committed on board the 'ſhip by a man that came with him, he gave him ſeveral blows 'and kicks, which the other received as the chaſtiſement of autho'rity, againſt which no reſiſtance was to be made, and which he 'had no right to reſent. Whether this authority was poſſeſſed by 'appointment or inheritance, we could not learn; but we obſerved 'that the chiefs were all elderly men. In other parts, however, we 'learnt that they poſſeſſed their authority by inheritance *.'

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 470.

With regard to the *religion* of the New Zealanders, all that could be learnt was, that they recognize the influence of ſuperior beings, of whom one is ſupreme, and the others ſubordinate, and have nearly the ſame notions of the origin of the world, and the production of mankind, as thoſe of the Otaheiteans. What homage they pay to theſe deities could not be learnt; for they ſeemed to have no places of public worſhip, like the Morais of the South Sea iſlands.

From New Zealand, Captain COOK proceeded to New Holland, now called *New South Wales*. He entered a bay on the eaſt ſide of the iſland, which, from the number of new plants collected by Mr BANKS and the other gentlemen, received the appellation of *Botany Bay*. In their progreſs along the coaſts of this bay, they ſaw ſeveral of the natives; and they remarked a very ſingular circumſtance in their oeconomy: Not one of them, men, women, or children, had the ſmalleſt veſtige of clothing on any part of their bodies, but the whole, without reſerve, was expoſed to public view. Notwithſtanding

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 471.

ing this defenceleſs condition, they were extremely hoſtile, and ſo intrepid, that two men, armed with a lance of about ten feet in length, and a ſhort club or ſtick, boldly attacked no leſs than forty of the ſhip's company. By way of enticement, and to procure reconciliation and mutual confidence, beads, ribbons, pieces of cloth, and other articles, were left in one of their houſes. Experiments of this kind were frequently repeated, but without producing the deſired effect; for, after examining theſe houſes many days after the preſents had been depoſited, they were held by them in ſuch ſovereign contempt, that the natives ſeemed not even to have touched them. Theſe bold people, however, after they had diſcovered the powerful effects of fire-arms, turned quite daſtardly, and, whenever they perceived any of the Europeans, though invited by every poſſible expreſſion of amity, would never admit any intercourſe, but uniformly fled into the woods.

New Holland, or New South Wales, is an iſland of immenſe extent. Captain COOK ſailed along its whole eaſtern coaſt, and found that its length, when reduced to a ſtraight line, is at leaſt twenty-ſeven degrees of latitude, amounting to about 2000 miles; hence he concludes, that its ſquare ſurface muſt far exceed that of all Europe. In this great range of coaſt, he had frequent occaſion to ſee many of the inhabitants. But, though ſome of them ventured near the ſhip, it was always with a hoſtile intention; and they could not, by alluring arts, bribes, and every poſſible mark of friendſhip, be induced to put any confidence in the Europeans. It was formerly mentioned, that the inhabitants of Botany Bay, both males and females, went ſtark naked, not employing even the ſimple veil of a fig-leaf. The ſame practice Captain COOK found to be univerſal through the whole extent of the eaſt coaſt of New South Wales, or New Holland. As far as Captain COOK and the other gentlemen could diſcover, this immenſe territory appeared to be totally uncultivated. The ſea affords much more liberal ſupplies of food to the inhabitants than the land. The fiſhes are of various kinds; but, if we except the mullet and a few ſhell-fiſh, the reſt are unknown in Europe. The reef and the ſhoals are frequented by incredible numbers of the fineſt green turtle, and oyſters of different ſpecies.

In this country, the number of inhabitants ſeems to bear no proportion to the extent of territory. 'We never ſaw,' ſays Captain COOK, 'ſo many of them as thirty together but once, and that was 'at Botany Bay, when men, women, and children, aſſembled upon 'a rock to ſee the ſhip paſs by: When they manifeſtly formed a 'reſolution to engage us, they never could muſter above fourteen or 'fifteen fighting men; and we never ſaw a number of their ſheds or 'houſes together that could accommodate a larger party *.'

We are informed by Captain COOK, that the men of this country are of a middle ſize, generally well made, clean limbed, and remarkably active, nimble, and vigorous; that there is a conſiderable expreſſion in their countenances, and their voices are very ſoft and effeminate; that their ſkins are ſo beſmeared with dirt, that it is difficult to aſcertain their real colour; that the dirt makes them appear nearly as black as Negroes; but that, by rubbing off the dirt, their genuine colour is a chocolate. Their features are by no means diſagreeable, neither are their noſes flat, nor their lips thick. Their teeth are white and even; and their hair, though frequently cropped, is naturally long and black: It was, in general, matted and filthy, though they uſe neither oil nor greaſe; yet what is aſtoniſhing, their heads

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 631.

heads were not infeſted with vermin. Their chief *ornament* is a bone, which is thruſt through a hole bored in the cartilage which divides the noſtrils. This bone is as thick as a man's finger, and ſix inches in length. It reaches quite acroſs the face; 'and ſo effectually,' Captain COOK informs us, 'ſtops up both noſtrils, that they are forced 'to keep their mouths wide open for breath, and ſnuffle ſo when they 'attempt to ſpeak, that they are ſcarcely intelligible to each other. 'Our ſeamen, with ſome humour, called it their *ſprit ſail-yard*; and 'indeed it had ſo ludicrous an appearance, that, till we were uſed to 'it, we found it difficult to reſtrain from laughter *.' They likewiſe wear necklaces made of ſhells, cut very neatly, and ſtrung together, bracelets of ſmall cord wound about the upper part of the arm, and a ſmall ſtring of plaited human hair tied round the waiſt. Beſides theſe, ſome of the natives uſed gorgets of ſhells which hung round the neck, and reached acroſs the breaſt. Though they uſe no clothes of any kind, their bodies have two coverings, one of dirt, and the other of paint, which laſt. They paint their whole bodies and limbs with patches of red and ſtripes of white, and not without diſplaying ſome degree of taſte. Upon their ſkin no veſtiges of diſeaſe or ſores were to be ſeen, except large ſcars diſpoſed in irregular lines, which were the remains of wounds they had inflicted upon themſelves as memorials of grief for the dead.

They ſeemed to have no fixed habitations; for neither towns nor villages were obſerved in the whole country. Their houſes, or rather hovels, were equally wretched and deſtitute of conveniences as thoſe at Terra del Fuego. At Botany Bay, where their habitations were beſt, they were juſt high enough for a man to ſit upright in, but not ſufficiently large to allow him to extend himſelf in any direction.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 633.

rection. They are built of pliable rods, about the thickneſs of a man's finger, which are bent in the form of an oven, by ſticking the two ends in the ground, and then covering them with pieces of bark and palm-leaves. Under theſe houſes, or ſheds, the natives ſleep, with their heels coiled up to their heads. In this ſtrange poſition, one of thoſe hovels will contain three or four perſons. The furniture of theſe houſes conſiſts chiefly of an oblong veſſel made of bark, and is uſed for bringing water from the ſpring; and a ſmall bag, about the ſize of a moderate cabbage-net, which they make by laying threads, or fibres, loop within loop, ſomething ſimilar to our manner of making purſes. 'This bag,' ſays Captain COOK, 'the 'man carries looſe upon his back by a ſmall ſtring which paſſes over 'his head; it generally contains a lump or two of paint and reſin, 'ſome fiſh-hooks and lines, a ſhell or two, out of which their hooks 'are made, a few points of darts, and their uſual ornaments, which in'cludes the whole worldly treaſure of the richeſt man among them*.'

Fiſh is their principal *food*, though they contrive ſometimes to kill the kanguroo, and even various kinds of birds. The yam is their chief article of vegetable food; but they alſo uſe ſeveral fruits, which their country ſpontaneouſly produces. Having no nets, they catch fiſh ſolely by ſtriking, and by hook and line.

The *weapons* of the New Hollanders conſiſt of ſpears and lances of different kinds. On the ſouthern part of the coaſt, ſome of them had four prongs pointed with bone, and barbed. Theſe barbed lances are dreadful weapons; for, when once they take place, they can never be extracted without tearing away the fleſh. Theſe weapons are thrown with great dexterity and force.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 636.

The *canoes* of the New Hollanders, eſpecially on the ſouthern part of the coaſt, are as rude as their habitations. They conſiſt of a ſingle piece of bark, about twelve feet in length, tied at the ends, and kept open in the middle by ſpars of wood. They draw but little water, and are ſo light that they eaſily go upon mud-banks in order to gather ſhell-fiſhes. Farther to the northward, the canoes are made of hollowed trunks of trees, about fourteen feet in length; and, as they are very narrow, to prevent their overſetting, they are furniſhed with an outrigger. Theſe veſſels, however, cannot carry more than four perſons.

From New Holland, Captain COOK directed his courſe for *New Guinea*. Captain COOK, Dr SOLANDER, and Mr BANKS, with their attendants, amounting to twelve men, well armed, approached the ſhore in the pinnace without moleſtation, and even without ſeeing any of the natives. This iſland ſeemed to abound with plantains, cocoa-nuts, and bread-fruit: But the gentlemen, dreading bad conſequences from the Indians, did not venture to cut down any of the trees. After advancing about a quarter of a mile from the boat, three of the natives, at about a hundred yards diſtance, ruſhed out of the wood, making a moſt hideous noiſe. 'As they ran towards us,' ſays Captain COOK, 'the foremoſt threw ſomething out of his hand, 'which flew on one ſide of him, and burnt exactly like gun-powder, 'but made no report. The other two inſtantly threw their lances 'at us; and, as no time was now to be loſt, we diſcharged our 'pieces, which were loaded with ſmall ſhot. It is probable that 'they did not feel the ſhot; for, though they halted a moment, they 'did not retreat; and a third dart was thrown at us. We then 'loaded our pieces with ball, and fired a ſecond time. By this diſcharge it is probable that ſome of them were wounded; yet we 'had the ſatisfaction to ſee that they all ran away with great agility *.' While Captain COOK and his attendants were returning to their boat, ſeveral of the natives were ſeen coming round a point, which was at the diſtance of about five hundred yards. Their number appeared to be between ſixty and a hundred. 'We now,' ſays Captain COOK, 'took a view of them at our leiſure. They 'made much the ſame appearance as the New Hollanders, being 'nearly of the ſame ſtature, and having their hair ſhort cropped. 'Like them alſo they were all ſtark naked.—All this while they were 'ſhouting defiance, and letting off their fires by four or five at a 'time. What theſe fires were, or for what purpoſe intended, we 'could not imagine.—This wonderful phenomenon was obſerved 'from the ſhip, and the deception was ſo great, that the people on 'board thought they had fire-arms; and, in the boat, if we had not 'been ſo near as that we muſt have heard the report, we ſhould 'have thought they had been firing volleys †.'

Captain COOK next reached the iſland of *Savu*, which lies in the latitude of about ten degrees ſouth. This iſland produces a great variety of vegetables; as the fan-palm, the cocoa-nut, tamarind, limes, oranges, mangoes, maize, Guinea corn, rice, millet, callevances, water melons, cellery, marjoram, fennel, betle, areca, tobacco, cotton, indico, &c. The tame, or domeſtic animals, are likewiſe numerous and abundant; as buffaloes, ſheep, goats, hogs, horſes, aſſes, dogs, cats, fowls, pigeons, &c.

The natives of Savu are rather below than above the middling ſize. The women, particularly, are remarkably ſhort and ſquat; their complexion is a dark brown, and their hair is univerſally black and lank. The men, in general, are well made, vigorous, and active, and

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 656.

† Ibid. p. 658.

and have an uncommon variety in the diſpoſition of their features. The countenances of the women, on the contrary, are uniformly alike. Both ſexes, by means of pincers, eradicate the hair from their arm-pits; and the men do the ſame with the hair on their beards. Both men and women wear garments made of cotton cloth dyed blue, and have not an inelegant appearance. Theſe people uſe a great variety of ornaments. Thoſe who are comparatively wealthy, have chains of plated gold-wire round their necks. 'They have 'alſo ornaments of beads,' Captain COOK informs us, 'which ſome 'wear round their necks as a ſolitaire, and others, as bracelets, upon 'their writs. Theſe are common to both ſexes; but the women 'have, beſides, ſtrings or girdles of beads, which they wear round 'their waiſts, and which ſerve to keep up their petticoat. Both 'ſexes had their ears bored, yet we never ſaw an ornament in any 'of them.—We ſaw ſome boys, who had ſpiral circles of thick 'braſs wire paſſed three or four times round their arms, above the 'elbow; and ſome men wore rings of ivory, two inches in breadth, 'and above an inch in thickneſs, upon the ſame part of the arm. 'Theſe, we were told, were the ſons of Rajas, or Chiefs, who wore 'theſe cumbrous ornaments as badges of their high birth. Almoſt 'all the men had their names traced upon their arms, in indelible 'characters of a black colour; and the women had a ſquare orna'ment of flouriſhed lines, impreſſed in the ſame manner, juſt under 'the bend of the elbow *.' Captain COOK likewiſe tells us, that he and the other gentlemen were ſtruck with the ſimilarity of theſe marks to thoſe made by tattowing in the iſlands of the South Sea.

In *Savu*, the *houſes* are all conſtructed on the ſame plan, their dimenſions being only larger or ſmaller in proportion to the wealth or rank of the proprietor. Some of them were four hundred feet in length, and others not above twenty. They are erected upon poſts of wood, about four feet in height, one end of which is driven into the ground, and upon the other a floor of wood is laid. Upon this floor other poſts are placed, and ſupport a roof with ſloping ſides, like our barns.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 686.

With regard to *food*, theſe people uſe every tame animal in their poſſeſſion, as hogs, horſes, buffaloes, poultry; and they even prefer dogs and cats to ſheep and goats. They are not very fond of fiſh, which is eaten chiefly by the poorer people. The fan-palm tree anſwers as a ſuccedaneum for almoſt every other ſpecies of food both to man and beaſt. A kind of wine, called *tuac*, or *toddy*, is procured by wounding the flower-buds ſoon after they appear, and fixing under them little baſkets, made of the leaves, which are ſo cloſe that they eaſily retain fluids. This juice is collected every morning and evening, and ſupplies with drink the whole inhabitants of the iſland. Of the ſurplus of this valuable and ſalutary juice, the natives make both a ſyrup and a coarſe ſugar. This juice, along with the huſks of rice, is given to the hogs, which, without any other nutriment, renders them prodigiouſly fat. In this iſland, both ſexes are enſlaved by the pernicious habit of chewing betle and areca, which they practiſe inceſſantly. With theſe ſubſtances they mix a kind of lime, made of ſhells and coral, and a quantity of tobacco. Hence their mouths are highly diſguſtful both to the ſight and to the ſmell. The lime and tobacco rot their teeth in ſuch a manner, that, in a ſhort time, they are totally covered by the gums.

The iſland of Savu is divided into five principalities, each of which is under the dominion of a Raja, or Chief. When differences ariſe among the inhabitants of any diſtrict, they are ſettled, without delay or appeal, by the Raja and his counſellors. There ſeemed not to be any intermediate rank between the Raja and the land-owners; and theſe laſt were eſteemed and reſpected in proportion to the extent and value of their poſſeſſions. The inferior orders of the natives conſiſt of manufacturers, labouring poor, and ſlaves. Like the peaſants in ſome parts of Europe ſtill, and formerly over all Europe, when the feudal ſyſtem prevailed, the ſlaves deſcend, and are conſidered as appendages of the land. Their chief object of pride, like that of the Scots and Welch, is a long pedigree of reſpectable anceſtors; and, of courſe, their veneration for antiquities of every kind is exceſſive. Near the principal town of his province, every ſucceſſive Raja erects, as a memorial of his reign, a large ſtone. Theſe ſtones are often of ſuch an enormous ſize, that, how they could be brought to their preſent ſituation, it is difficult to conceive, even though all our mechanical powers had, for centuries paſt, been perfectly known among the natives of this iſland. Theſe ſtones not only ſerve as records of the reigns of their Princes; but, when a Raja dies, a general feaſt is proclaimed through his dominions, and all his ſubjects aſſemble round the ſtones, and feaſt for weeks, and ſometimes months, according to the quantity of live ſtock they can procure *.

'The *religion* of theſe people,' ſays Captain **Cook**, 'according 'to Mr Lange's information, is an abſurd kind of Paganiſm, every 'man chuſing his own god, and determining for himſelf how he 'ſhould be worſhipped; ſo that there are almoſt as many gods and 'modes of worſhip as people. In their morals, however, they are 'ſaid to be irreproachable, even upon the principles of Chriſtianity.

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* See Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 694.

'No man is allowed more than one wife; yet an illicit commerce 'between the ſexes is in a manner unknown among them; and in'ſtances of theft are very rare *.

From Savu, Captain COOK ſailed to *Java*, the capital of which is *Batavia*. Around this city, for ſeveral miles, is a continued range of country houſes and gardens. Many of theſe gardens are very large, and, by ſome odd taſte, or rather ſtrange fatality, they are planted with numerous trees, which deprives the air of that ſalubrity formerly derived to the iſland from its being originally cleared of wood. Theſe thick and almoſt impenetrable foreſts ſtand in a dead flat, which extends ſome miles beyond them, and is interſected in almoſt every direction by ſluggiſh rivers, and ſtill more by artificial canals for the navigation of ſmall veſſels. Beſides, the fence of every field and garden is a ditch; and, to add to the calamitous effects of an atmoſphere impregnated with all the ſeeds of diſeaſe and death, the cultivated grounds are interſperſed with noxious fens, bogs, and moraſſes.

'It is not ſtrange,' Captain COOK judiciouſly remarks, 'that the 'inhabitants of ſuch a country ſhould be familiar with diſeaſe and 'death. Preventive medicines are taken almoſt as regularly as food; 'and every body expects the returns of ſickneſs, as we do the ſea'ſons of the year. We did not ſee a ſingle face in Batavia that in'dicated perfect health; for there is not the leaſt tint of colour in 'the cheeks either of man or woman. The women, indeed, are 'moſt delicately fair; but, with the appearance of diſeaſe, there ne'ver can be perfect beauty. People talk of death with as much in'difference as they do in a camp; and, when an acquaintance is ſaid

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* See Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 697.

‘ to be dead, the common reply is, “ Well, he owed me nothing ;”
‘ or, “ I muſt get my money of his executors.”

Such a country, and ſuch a picture of human miſery, and of human deſtruction, impreſſes the mind with many of the moſt painful feelings. One would be tempted to wiſh, that an iſland, ſo deleterious to our ſpecies, ſhould at once be ſwallowed up by the ocean. According to our conceptions, ſuch a revolution would be a moſt benevolent act of Providence. But here we muſt pauſe. The Dutch, who are, perhaps, the moſt commercial, and, of courſe, the moſt ſelfiſh, intereſted, and unfeeling people in Europe, inſtead of draining this iſland, and clearing it of noxious wood, have augmented its natural evils, by multiplying trees, ditches, canals, and every other nuiſance which could render the place ſtill more deſtructive to its inhabitants. Here Providence is entirely exculpated. If the Dutch, inſtead of their former and preſent mode of management, had cleared the iſland of ſuperfluous trees, drained its marſhes, and erected their houſes on more elevated ſituations, Java, now the almoſt certain grave of every European who ventures to reſide in it for any length of time, might have been one of the moſt pleaſant, as well as moſt wholeſome iſlands on this globe.

This iſland preſents to the view of ſtrangers the moſt heterogeneous mixture of human beings, croſſed in their production, by an amazing number of bizarre combinations. In the town of Batavia, and the adjacent country, the Indians, as they are called, are not the genuine natives of the iſland of Java, but ſpurious commixtures originating from the various iſlands from which the Dutch import ſlaves. In this country, both ſexes bathe themſelves in the river at leaſt once a-day, a practice, in hot climates, equally neceſſary to health and to perſonal delicacy.

Among the Batavians, the brutal, or rather mad cuſtom, called *running a muck*, is very ancient and ſtill prevails. To run *a muck*, in the original ſenſe of the word, is firſt to get drunk with eating opium, and then run into the ſtreet with a naked ſword, or other weapon, and kill whoever comes in the way, till the frantic perſon himſelf is either killed or taken priſoner. 'Of this,' ſays Captain COOK, 'ſeveral inſtances happened while we were at Batavia; and one of 'the officers, whoſe buſineſs it is, among other things, to apprehend 'ſuch people, told us, that there was ſcarcely a week in which he, 'or ſome of his brethren, were not called upon to take ſome of them 'into cuſtody. In one of the inſtances that came to our knowledge, 'the party had been ſeverely injured by the perfidy of women, and 'was mad with jealouſy before he made himſelf drunk with opium; 'and we were told, that the Indian who runs *a muck* is always firſt 'driven to deſperation by ſome outrage, and always firſt revenges 'himſelf upon thoſe who have done him wrong. We were alſo 'told, that, though theſe unhappy wretches afterwards run into the 'ſtreet with a weapon in their hand, frantic and foaming at the 'mouth, yet they never kill any but thoſe who attempt to apprehend 'them, or thoſe whom they ſuſpect of ſuch an intention, and that 'whoever gives them way is ſafe. If the officer takes one of theſe '*amocks*, or *mohawks*, as they have been called by an eaſy corruption, his reward is very conſiderable; yet, ſuch is the fury of their 'deſperation, that three out of four are of neceſſity deſtroyed in the 'attempt to ſecure them, though the officers are provided with inſtruments, like large tongs or pincers, to lay hold of them without 'coming within reach of their weapon *.' Such of theſe unhappy wretches as are taken alive, are broken upon the wheel at the place where they committed the firſt murder.

With regard to *religion*, theſe people are not ſingular in obſerving the moſt abſurd practices, and in believing the moſt ridiculous opinions. They believe that the Devil, whom, it is not incurious, they denominate *Satan*, is the being who gives riſe to all the diſeaſes and all the calamities of human life. Hence, when they are ſick, or in any diſtreſsful circumſtances, as a propitiation, they conſecrate, to this ideal enemy of mankind, meat, money, &c. 'If,' ſays Captain COOK, 'any one among them is reſtleſs, and dreams for two or three 'nights ſucceſſively, he concludes that Satan has taken that method 'of laying his commands upon him, which if he neglects to fulfil, 'he will certainly ſuffer ſickneſs or death, though they are not re'vealed with ſufficient perſpicuity to aſcertain their meaning †.' Theſe people entertain another ſuperſtitious notion, which has ſtill leſs connection with the general train of human conceptions. They believe that a woman, when delivered of a child, frequently, at the ſame time, brings forth a young crocodile, as a twin to the infant. 'They 'believe,' Captain COOK informs us, 'that theſe creatures are re'ceived moſt carefully by the midwife, and immediately carried 'down to the river, and put into the water. The family in which 'ſuch a birth is ſuppoſed to have happened, conſtantly put victuals 'into the river for their amphibious relation, and eſpecially the twin, 'who, as long as he lives, goes down to the river, at ſtated ſeaſons, 'to fulfil his fraternal duty; for the neglect of which, it is the uni'verſal opinion, that he will be viſited with ſickneſs or death ‡.'

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 754. *et ſeqq.*

† Ibid. p. 755.

‡ Ibid. p. 756.

Theſe crocodile twins, in that country, are called *Sudaras*, of which many ridiculous ſtories are related, and believed. The Bougis, Boetons, and Macaſſars, firmly perſuaded that they have crocodile relations in their rivers, perform a periodical ceremony in remembrance of them. 'Large parties of them,' we are informed by Captain COOK, 'go out in a boat, furniſhed with great plenty of proviſions, 'and all kinds of muſic, and row backwards and forwards, in places 'where crocodiles and alligators are moſt common, ſinging and weep'ing by turns, each invoking his kindred, till a crocodile appears, 'when the muſic inſtantly ſtops, and proviſions, betle, and tobacco, 'are thrown into the water *.'

In Java, except the native Indians, the Chineſe are the moſt numerous claſs of inhabitants, and are both an induſtrious and ingenious people. They employ themſelves as ſhip-carpenters, ſmiths, joiners, tailors, makers of ſlippers, dyers of cotton, and embroiderers. Some of them are likewiſe diſperſed through different parts of the country, where they cultivate gardens, ſow rice, plant ſugar-canes, or feed cattle and buffaloes, the milk of which they bring daily to Batavia for ſale. Their induſtry is great and highly laudable; but other parts of their character are deteſtable. 'There is nothing,' Captain COOK remarks, 'clean or dirty, honeſt or diſhoneſt, provided there is not 'too much danger of a halter, that the Chineſe will not readily do 'for money. But, though they work with great diligence, and pa'tiently undergo any degree of labour; yet, no ſooner have they 'laid down their tools, than they begin to game at cards, dice, &c.' 'To gaming,' continues our author, 'they apply with ſuch eagerneſs, 'as ſcarcely to allow time for the neceſſary refreſhments of food and 'ſleep; ſo that it is as rare to ſee a Chineſe idle, as it is to ſee a

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 759.

'Dutchman or an Indian employed. In manners, they are always 'civil, or rather obſequious; and, in dreſs, they are remarkably clean 'and neat, to whatever rank of life they belong *.'

The Chineſe, in general, are eaſily ſatisfied with food. That of the poorer people conſiſts of rice, with a ſmall proportion of fleſh or fiſh. 'They have greatly the advantage,' ſays Captain COOK, 'of 'the Mahometan Indians, whoſe religion forbids them to eat of 'many things which they could moſt eaſily procure. The Chineſe, 'on the contrary, being under no reſtraint, eat, beſides pork, dogs, 'cats, frogs, lizards, ſerpents of many kinds, and a great variety of 'ſea-animals, which the other inhabitants of this country do not conſider as food. They eat alſo many vegetables, which an European, 'except he was periſhing with hunger, would never touch †.'

With regard to the *burial* of their dead, the Chineſe obſerve a ſingular cuſtom, or rather ſuperſtition. Where a body has been interred, they will not open the ſame ground a ſecond time. Hence their burying-grounds, in the environs of Batavia, occupy many hundred acres; and the Dutch, who grudge the waſte of ſo much uſeful land, refuſe to ſell any for this purpoſe, without receiving moſt exorbitant prices. The money, however, is commonly raiſed. 'Under the 'influence,' ſays Captain COOK, 'of this univerſal prejudice, they 'take an uncommon method to preſerve the body entire, and prevent 'the remains of it from being mixed with the earth that ſurrounds 'it. They incloſe it in a large thick coffin of wood, not made of 'planks joined together, but hollowed out of the ſolid timber, like a 'canoe. This being covered, and let down into the grave, is ſurrounded with a coat of their mortar, called *Chinam*, about eight or

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 760.

† Ibid.

‘ ten inches thick, which, in a ſhort time, becomes as hard as a ſtone. ‘ The relations of the deceaſed attend the funeral ceremony, with a ‘ conſiderable number of women that are hired to weep *.’

Slaves form another, and a numerous, claſs of the inhabitants of this country. The Dutch, the Portugueſe, and even the Indians, are conſtantly attended and ſerved by ſlaves, who are purchaſed from Sumatra, Malacca, and moſt of the Eaſtern iſlands. Theſe ſlaves, Captain Cook informs us, ‘ are a very lazy ſet of people; but, as they ‘ do but little work, they are content with a little victuals, ſubſiſting altogether upon boiled rice, and a ſmall quantity of the cheapeſt ‘ fiſh. As they are natives of different countries, they differ from ‘ each other extremely both in perſon and diſpoſition. The African ‘ Negroes, called here *Papua*, are the worſt, and conſequently may ‘ be purchaſed for the leaſt money. They are all thieves, and ‘ all incorrigible. Next to theſe are the Bougis and Macaſſars, ‘ both from the iſland of Celebes: Theſe are lazy in the higheſt degree; and, though not ſo much addicted to theft as the Negroes, ‘ have a cruel and vindictive ſpirit, which renders them extremely ‘ dangerous; eſpecially as, to gratify their reſentment, they will make ‘ no ſcruple of ſacrificing life †.’ With reſpect to any puniſhment leſs than death, theſe ſlaves are entirely under the dominion of their maſters.

From the iſland of Java, Captain Cook proceeded to the Cape of Good Hope, a country, he remarks, which has been ſo often deſcribed, and is ſo well known in Europe, that he confines his obſervations to a few facts which had either been omitted or miſrepreſented by preceding voyagers.

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 761.

† Ibid. p. 762.

Notwithſtanding the favourable, and even ſplendid, repreſentations which have repeatedly been given of this country, Captain Cook tells us, that, during his whole moſt extenſive voyage, 'he never ſaw a 'more forlorn appearance, nor in reality a more ſterile deſert. The 'land over the Cape, which conſtitutes the peninſula formed by 'Table Bay on the north, and Falſe Bay on the ſouth, conſiſts of 'high mountains, altogether naked and deſolate. The land behind 'theſe to the eaſt, which may be conſidered as the iſthmus, is a plain 'of vaſt extent, conſiſting almoſt wholly of a light kind of ſea-ſand, 'which produces nothing but heath, and is utterly incapable of 'cultivation. All the ſpots that will admit of improvement, which 'together bear about the ſame proportion as one to a thouſand, 'are laid out in vineyards, orchards, and kitchen-grounds; and 'moſt of theſe little ſpots lie at a conſiderable diſtance from each 'other *.' From theſe facts, Captain Cook remarks, there is great reaſon to conclude, that, in the interior parts of this country, the cultivated parts do not bear a greater proportion to thoſe which are incorrigibly ſterile. The Dutch have ſettlements at the diſtance of twenty-eight days' journey, (about nine hundred miles), from which proviſions are brought by land to the Cape; 'ſo that,' ſays Captain Cook, 'it ſeems reaſonable to conclude, that proviſions are not to 'be had within a leſs compaſs. While we were at the Cape, a farm'er came thither from the country, at the diſtance of fifteen days 'journey, and brought his young children with him. We were ſur'priſed at this, and aſked him, if it would not have been better to 'have left them with his next neighbour? Neighbour! ſaid the 'man, I have no neighbour within leſs than five days journey of me. 'Surely the country muſt be deplorably barren, in which thoſe who 'ſettle only to raiſe proviſions for a market, are diſperſed at ſuch

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 785.

‘ diſtances from each other. That the country is every where deſti-
‘ tute of wood, appears to demonſtration; for timber and planks are
‘ imported from Batavia, and fuel is almoſt as dear as food *.’

The inhabitants of this place are chiefly Dutch, at leaſt, they are more numerous here than in Batavia. In general, the women are handſome. Their ſkin is fine and clear; and they have a bloom of complexion which is highly expreſſive of vigour and health. They make excellent mothers and miſtreſſes of families; and they are remarkably prolific. Here the air is very ſalubrious; and diſeaſes brought hither from Europe, or other remote regions, are ſpeedily cured. Though both the ſoil and the climate are in ſome meaſure unfavourable to cultivation, and to the breeding of cattle; yet induſtry, which often produces moſt ſurpriſing effects, has ſupplied this place with the greateſt profuſion of the neceſſaries, and even the luxuries of life.

‘ Of the natives of this country,’ Captain COOK remarks, ‘ we
‘ could learn but little, except from report; for there were none of
‘ their habitations, where alone they retain their original cuſtoms,
‘ within leſs than four days journey from the town. Thoſe that we
‘ ſaw at the Cape were all ſervants to Dutch farmers, whoſe cattle
‘ they take care of, and are employed in other drudgery of the meaneſt kind. Theſe are, in general, of a ſlim make, and rather lean
‘ than plumb, but remarkably ſtrong, nimble, and active. Their ſize
‘ is nearly the ſame with that of Europeans; and we ſaw ſome that
‘ were ſix feet high. Their eyes are dull, and without expreſſion.
‘ Their ſkins are of the colour of ſoot; but that is, in a great mea-
‘ ſure, cauſed by the dirt, which is ſo wrought into the grain, that it
‘ cannot

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 786.

'cannot be diſtinguiſhed from complexion; for I believe they never 'waſh any part of their bodies. Their hair curls ſtrongly, not like 'a Negroe's, but falls in ringlets about ſeven or eight inches long. 'Their clothing conſiſts of a ſkin, generally that of a ſheep, thrown 'over their ſhoulders; beſides which, the men wear a ſmall pouch 'in the middle of the waiſt, and the women, a broad leather flap, 'both which hang from a girdle or belt that is adorned with beads 'and ſmall pieces of copper. Both men and women wear necklaces, 'and ſometimes bracelets of beads; and the women wear rings of 'hard leather round their ankles, to defend them from the thorns, 'with which their country every where abounds *.'

The language of the Hottentots, Captain COOK tells us, ſeems to be ſcarcely articulate. While ſpeaking, they have a ſtrange mode, at very frequent intervals, of clucking with their tongues againſt the roof of their mouths. Theſe clucks ſeem to have no other meaning than to divide what they ſay into ſentences. They are naturally a modeſt, and even a ſhy people.

Captain COOK and the other gentlemen made many inquiries of the Dutch concerning the preſent ſtate and manners of the Hottentots; and he was told a number of particulars which he relates entirely on the credit of his informers. From them he learned that there are ſeveral nations of Hottentots within the Dutch ſettlements, who differ greatly in their cuſtoms and manner of living. All of them, however, are repreſented as peaceable and friendly, except one clan ſituated to the eaſtward, whom the Dutch diſtinguiſh by the name of *Boſch-men*, who live entirely by plunder, or rather theft; for they are ſaid never to make open attacks, but to ſteal the cattle privately in

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† Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 789.

in the night. To defend themſelves, however, when detected, they uſe lances and bows, the arrows of which they poiſon, ſome with the juice of herbs, and others with the venom of the ſerpent called *Cobra di Capello*. Stones, in the hands of theſe people, are likewiſe formidable weapons; for they can throw ſtones with ſuch force and dexterity, as repeatedly to hit a dollar at the diſtance of a hundred paces. 'As a defence againſt theſe freebooters,' Captain COOK tells us, 'the other Indians train up bulls, which they place round 'their towns in the night, and which, upon the approach of either 'man or beaſt, will aſſemble and oppoſe them, till they hear the 'voice of their maſters encouraging them to fight, or calling them 'off, which they obey with the ſame docility as a dog *.'

Among the Hottentots, the chiefs, of whom many poſſeſs numerous herds of cattle, are commonly dreſſed in the ſkins of lions, tygers, or zebras, ornamented with fringes, and other trinkets, which indicate no deſpicable taſte. 'Both ſexes,' Captain COOK tells us, 'anoint the body with greaſe, but never uſe any that is rancid or 'foetid, if freſh can be had. Mutton-ſuet and butter are generally 'uſed for this purpoſe.—We were told that the prieſt certainly gives 'the nuptial benediction by ſprinkling the bride and bridegroom 'with his urine. But the Dutch univerſally declared, that the women never wrapped the entrails of ſheep round their legs, as they 'have been ſaid to do, and afterwards make them part of their 'food †.'

Captain COOK wiſhed to determine a great queſtion among natural hiſtorians, whether the Hottentot women have that fleſhy flap or apron diſtinguiſhed by the appellation of the *ſinus pudoris*. The following paſſage contains all that could be diſcovered with regard to that ſubject: 'Many of the Dutch and Malays, who ſaid 'they had received favours from Hottentot women, poſitively de'nied its exiſtence; but a phyſician of the place declared that he 'had cured many hundreds of venereal complaints, and never ſaw 'one without two fleſhy, or rather ſkinny appendages, proceeding 'from the upper part of the *labia*, in appearance ſomewhat reſem'bling the teats of a cow, but flat; they hung down, he ſaid, before 'the *pudendum*, and were, in different ſubjects, of different lengths; 'in ſome not more than half an inch, in others three or four inches. 'Theſe he imagined to be what ſome writers have exaggerated into 'a flap or apron, hanging down from the bottom of the abdomen, 'of ſufficient extent to render an artificial covering of the neigh'bouring parts unneceſſary *.'

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 790. *et ſeqq.*

† Ibid. p. 791.

In the iſland of Amſterdam, Captain COOK and his aſſociates ſaw ſeveral places of worſhip, which the natives denominated *A-fia-touca*. Theſe houſes were erected on the tops of artificial mounts, about eighteen feet high. They were of an oblong figure, and incloſed by a parapet of ſtone, nearly three feet in height. From this parapet, or wall, the mount, which was covered with green turf, roſe in a gently ſloping direction; and, on the top of it ſtood the houſe or temple, which had the ſame figure as the mount, and was about twenty feet long and fourteen or ſixteen broad. 'As ſoon,' ſays Captain COOK, 'as we came before the place, every one ſeated 'himſelf on the green, about fifty or ſixty yards from the houſe. 'Preſently came three elderly men, who ſeated themſelves between 'us and it, and began a ſpeech, which I underſtood to be a prayer,

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* Hawkeſworth's Narrative of Cook's Voyage, vol. 3. p. 792.

'it being wholly directed to the houſe. This laſted about ten minutes; 'and then the prieſts, for ſuch I took them to be, came and ſat 'down along with us, when we made them preſents of ſuch things 'as we had about us *.'

Theſe *Aſiatoucas*, or places of worſhip, are frequent, and diſperſed over the whole iſland. Inſtead of returning to the ſhip, the natives conducted Captain Cook and his retinue into the country by a road, which was about ſixteen feet broad, and perfectly level. This road appeared to be a very common, and even a principal one; for many other roads, in different directions, interſected and terminated in it. The whole of theſe roads were incloſed on each ſide with neat fences made of reeds, and ſhaded from the ſcorching rays of the ſun by fruit-trees. 'I thought I was tranſported,' Captain Cook remarks, 'into the moſt fertile plains in Europe. There was not an inch of 'waſte ground; the roads occupied no more ſpace than was abſo'lutely neceſſary; the fences did not take up above four inches 'each; and even this was not wholly loſt; for in many were plant'ed ſome uſeful trees or plants. It was every where the ſame; 'change of place altered not the ſcene. Nature, aſſiſted by a little 'art, no where appears in more ſplendour than at this iſle. In theſe 'delightful walks we met numbers of people; ſome travelling down 'to the ſhips with their burdens of fruit; others returning empty. 'They all gave us the road, by turning either to the right or left, 'and ſitting down or ſtanding, with their backs to the fences, till 'we had paſſed †.'

In theſe iſlands, as well as thoſe of New Zealand, &c. their common method of ſalutation is by making their noſes touch each other. Their

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[*] Cook's Voyage, 1772, &c. vol. I. p. 198.

[†] Ibid. p. 201.

Their unſuſpicious mode of behaviour induced Captain COOK and the other gentlemen to think that theſe people were ſeldom diſturbed either by foreign or domeſtic broils; yet their weapons, ſuch as ſwords and ſpears made of hard wood, bows and arrows, were very formidable. Some of their ſpears have many barbs, and muſt be exceedingly dangerous inſtruments of war. Another ſingular cuſtom is worthy of remark. When any preſent is given to them, if acceptable, they apply it to their heads. 'This manner of paying 'a compliment,' ſays Captain COOK, 'is taught them from their 'very infancy; for, when we gave things to little children, the 'mother lifted up the child's hand to its head.—Sometimes they 'would look at our goods, and, if not approved, return them back; 'but, whenever they applied them to the head, the bargain was in'fallibly ſtruck *.'

In theſe iſlands, a cuſtom of a very peculiar nature prevails. The greater part of the inhabitants, both male and female, were obſerved to have loſt one, or both of their little fingers †. This cuſtom ſeemed not to be characteriſtic of rank, of age, or of ſex; for, if ſome young children be excepted, very few people were diſcovered in whom both hands were perfect ‡. They likewiſe burn or make inciſions in their cheeks; but, whether this ſtrange practice was meant as expreſſive of grief, or of any other violent paſſion, could not be diſcovered.

With regard to *government*, Captain COOK remarks, a perſon, endowed with the character of *King*, ' was pointed out to us; and ' we had no reaſon to doubt it. From this and other circumſtances, ' I am of opinion, that the government is much like that of Otaheite; that is, in a king or great chief, who is here called *Areeke*, ' with other chiefs under him, who are lords of certain diſtricts, ' and perhaps ſole proprietors, to whom the people ſeem to pay ' great obedience.—I am of opinion, that all the land on *Tongatabu* ' (or Amſterdam iſland) is private property, and that there are here, ' as at Otaheite, a ſet of people who are ſervants or ſlaves, and have ' no property in land. It is unreaſonable to ſuppoſe every thing in ' common in a country ſo highly cultivated as this *.—The high ' ſtate of cultivation their lands are in, muſt have coſt them immenſe ' labour. This is now amply rewarded by the great produce, of ' which every one ſeems to partake. No one wants the common ' neceſſaries of life; joy and contentment are painted in every face. ' Indeed, it can hardly be otherwiſe; an eaſy freedom prevails ' among all ranks of people; they feel no wants which they do not ' enjoy the means of gratifying; and they live in a clime where ' the painful extremes of heat and cold are equally unknown †.'

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* Cook's Voyage, 1772, &c. vol. 1. p. 221.

† This ſpecies of mutilation is not confined to the natives of the Friendly iſlands.—See Recherches Philoſophiques ſur les Americains, tom. 2. p. 253.

‡ Cook's Voyage, Ibid. p. 222.

The exiſtence of CANNIBALS, or eaters of human fleſh, has often been mentioned by voyagers, and as often diſcredited by moſt philoſophers. But Captain COOK, and other late navigators, have removed every doubt concerning this, to us at leaſt, moſt ſhocking practice. In New Zealand, ſome of Captain COOK's officers, when viſiting the habitations of the natives, ſaw ſeveral human thighbones, from which the fleſh had been but recently picked ‡. A few days after this diſcovery, another party of officers went aſhore in

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[*] Cook's Voyage, 1772, &c. vol. 1. p. 223. &c.

[†] Ibid.

[‡] Ibid. p. 241.

Queen Charlotte's Bay, 'where they ſaw the head and bowels of a 'youth, who had lately been killed, lying on the beach, and the 'heart ſtuck on a forked ſtick, which was fixed to the head of one 'of the largeſt canoes. One of the gentlemen bought the head, 'and brought it on board, where a piece of the fleſh was broiled 'and eaten by one of the natives, before all the officers, and moſt 'of the men *.' When this ſtrange affair happened, Captain Cook was on ſhore. After returning on board, he was informed of the circumſtances juſt related. He found the quarter-deck crowded with natives, 'and the mangled head, or rather part of it, (for the 'under jaw and lip were wanting), lying on the tafferal. The ſkull 'had been broken on the left ſide, juſt above the temple; and the 'remains of the face had all the appearance of a youth under twenty. 'The ſight of the head, and the relation of the above circumſtances, 'ſtruck me with horror, and filled my mind with indignation againſt 'theſe cannibals. Curioſity, however, got the better of my indig'nation, eſpecially when I conſidered that it would avail but little; 'and being deſirous of becoming an eye-witneſs of a fact which 'many doubted, I ordered a piece of the fleſh to be broiled and 'brought to the quarter-deck, where one of theſe cannibals eat it 'with ſurpriſing avidity. This had ſuch an effect upon ſome of 'our people as to make them ſick †.'

Captain Cook, however, after expreſſing a juſt abhorrence againſt this deteſtable, and, to us, moſt unnatural practice, candidly acknowledges, that theſe people eat only thoſe whom they ſlay in battle. Tupia, who frequently expoſtulated with them againſt this worſe than brutal cuſtom, received for reply, 'Can there be any harm in 'eating

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* Cook's Voyage, 1772, &c. vol. I. p. 243.

† Ibid. and p. 244. 245.

‘ eating our enemies, whom we have killed in battle? Would not ‘ thoſe very enemies have done the ſame to us *?’

The New Zealanders, by their general deportment, and active vigilance, ſeem to live under perpetual apprehenſions of being deſtroyed by each other. Moſt of their tribes have either actually, or imagine they have ſuſtained wrongs from ſome other tribe, and, of courſe, are always watching for opportunities of revenge. ‘ And, ‘ perhaps,’ Captain COOK remarks, ‘ the deſire of a good meal may ‘ be no ſmall incitement.—Their method of executing their horrible ‘ deſigns, is by ſtealing upon the adverſe party in the night; and, ‘ if they find them unguarded, (which, however, I believe is ſeldom ‘ the caſe), they kill every one indiſcriminately, not even ſparing ‘ the women and children. When the maſſacre is completed, they ‘ either *feaſt* and *gorge* themſelves upon the ſpot, or carry off as ‘ many of the dead bodies as they can, and *devour* them at home, ‘ with acts of brutality too ſhocking to be deſcribed †.’ To give quarter, or to take priſoners, conſtitute no part of military law in New Zealand. Theſe perpetual hoſtilities, and the ſhocking manner of conducting them, produce in the inhabitants an habitual circumſpection and dread. ‘ Indeed,’ ſays Captain COOK, ‘ no other ‘ men can have ſuch powerful motives to be vigilant, as the preſer- ‘ vation both of body and *ſoul* depends upon it. For, according to ‘ their ſyſtem of belief, the *ſoul* of the man whoſe fleſh is devoured ‘ by the enemy, is doomed to *a perpetual fire*; while the ſoul of the ‘ man whoſe body has been reſcued from thoſe who killed him, as ‘ well as the ſouls of all who die a natural death, aſcend to the habi- ‘ tations of the gods. I aſked, Whether they eat the fleſh of ſuch

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* Cook's Voyage, 1772, &c. vol. 1. p. 246.

† Cook's Voyage, 1776, &c. vol. 1. p. 137.

‘ of their friends as had been killed in war, but whoſe bodies were ‘ ſaved from falling into the enemy's hands? They ſeemed ſurpriſed ‘ at the queſtion, which they anſwered in the negative, expreſſing ‘ ſome abhorrence at the very idea. Their common method of diſ‐ ‘ poſing of their dead, is by depoſiting their bodies in the earth; but, ‘ if they have more of their ſlaughtered enemies than they can *eat*, ‘ they throw them into the ſea *.’

THESE reſpectable, and ſome of them recent authorities, are fully ſufficient to ſhow that cannibals in ſome parts of the New World exiſt even in our own times. From authorities no leſs reſpectable, I ſhall proceed to ſhow, that the practice of *eating human fleſh* was formerly not uncommon in various regions of the Old Continent. The ancient Greeks of Peloponneſus, now known by the appellation of *Morea*, went, like the beaſts of the foreſt, perfectly naked, and eat *human fleſh* with avidity, at which, PALMERIUS remarks, the modern practice of the American nations forbids us to wonder. But certain ſacred nymphs, who officiated in the temples, reprobated the practice of eating human fleſh, and likewiſe taught the inhabitants of that diſtrict of Greece, for the ſake of modeſty, to cover themſelves with the inner bark of trees, or with the ſkins of beaſts †. The Jews, ſo late as the days of Trajan, having overcome a conſiderable army compoſed of Greeks and Romans, near Cyrene, *eat* thoſe who fell in battle, devoured their entrails, anointed themſelves with their blood, and made clothes of their ſkins [*]. The Padaei, a nation of India, ſays **HERODOTUS**, live upon raw fleſh. When either males or females approached toward old age, they were *ſlain* and *devoured* by their neareſt relations or neighbours. They were never allowed to be emaciated by diſeaſe, leſt their *fleſh* ſhould become corrupted, and, of, courſe, unpalatable. They were ſeldom, however, permitted to reach this ſtage of diſeaſe; for they were ſlaughtered and *eaten* long before that period arrived [†].

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* Cook's Voyage, &c. vol. 1. p. 138.—See other inſtances of a ſimilar nature in Forſter's Voyage, vol. 1. p. 512. vol. 2. p. 77. 300. 315.

† Palmer. Graec. Antiq. deſcript. p. 55. 56.

The Myſi, a people of Aſia, in the neighboured of Troas, killed and *eat* ſuch priſoners as they took in war [‡]. Why, ſays **HIERONYMUS**, do I ſpeak of other nations, when I ſaw, while I was in Gaul, the *Scots*, who inhabit a conſiderable part of the iſland of Britain, *eat human fleſh*; and, when they found in the woods ſhepherds and keepers of hogs, they cut off the *hips* of the men and the *breaſts* of the women, which they eſteemed as the moſt delicious repaſt [‖]. In deſcribing the Scythians, **HERODOTUS** informs us, that to the north of a certain deſert, a nation exiſted in his time called *Androphagi*, becauſe they feaſted on *human fleſh* [§]. **HERODOTUS**, in the ſame book, makes frequent mention of theſe Androphagi. **ANTONY**, with a view to overturn the Roman government, took a ſolemn oath from his aſſociates, which was attended with a moſt infamous ſolemnity. After ſacrificing a *boy*, the oath was adminiſtered over his entrails, which afterwards were *eaten* by theſe conſpirators [**].

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[*] Dio Caſſ. Rom. Hiſt. edit. Xiphilin. p. 556.

[†] Herodot. Thalia, ſ. lib. 3. edit. Gronov. p. 199.

[‡] Flor. lib 4. c. 12.; and Schedius de Diis Germanis, p. 403.

[‖] Hieron. adver. Jovian. lib. 2.

[§] Herodot. Melpomone, ſ. lib. 4. § 18.

[**] Dio Caſſ. edit. Xiphilini, 27.

In New Zealand, there are no *Morais*, or other places of public worſhip. But they have prieſts, who alone addreſs the gods in propitiatory prayers for the ſucceſs of enterpriſes againſt enemies, of fiſhing parties, and of other temporal affairs. Notwithſtanding the hoſtile ſtate and almoſt perpetual wars carried on among the different tribes into which theſe people are divided, travelling ſtrangers, who have no evil intentions, are well received and entertained during their ſtay, which, however, it is expected, will be no longer than is neceſſary to execute the buſineſs they came to tranſact. Here polygamy is permitted; and it is not unuſual for one man to have two or three wives. The New Zealanders ſeem to be perfectly ſatisfied with the ſmall portion of knowledge they poſſeſs, without attempting to increaſe it. In them, new and even ſurpriſing objects excite little or no ſurpriſe; and it is difficult, even for a moment, to fix their attention. This ſpecies of apathy, though contrary to our ideas, and almoſt our comprehenſion, is common to moſt of the natives of the South Sea iſlands. Curioſity, or rather the love of examining new objects, and of acquiring knowledge, we have always been led to conſider, and to feel, as one of the ſtrongeſt propenſities in human nature. But in moſt of the South Sea iſlands, and among moſt ſavage people, the natives ſeem to want this propenſity; if otherwiſe, it has little or no influence upon their minds.

DRAMATIC ENTERTAINMENTS, or the recital of comic or tragic ideas in the form of dialogue, together with real or alluſive repreſentations, are, in the Old World, as ancient as the records of hiſtory.

In many of the detached iſlands ſcattered over the great Pacific Ocean, public amuſements of this kind are not unfrequent.

When Captain COOK and the other gentlemen were at Otaheite, in April 1773, they were conducted to the theatre, 'where,' ſays he, 'we were entertained with a dramatic *heava*, or *play*, in which were 'both dancing and comedy. The performers were five men, and 'one woman, who was no leſs a perſon than the King's ſiſter. The 'muſic conſiſted of three drums only; it laſted about an hour and 'an half, or two hours; and, upon the whole, was well conducted. 'It was not poſſible for us to find out the meaning of the play. 'Some part ſeemed adapted to the preſent time, as my name was 'frequently mentioned. Other parts were certainly unconnected 'with us. It apparently differed in nothing, that is, in the manner 'of acting it, from thoſe we ſaw at Ulietia, in my former voyage. 'The dancing-dreſs of the lady was more elegant than any I ſaw 'there, by being decorated with long taſſels, made of feathers, hanging from the waiſt downward. As ſoon as all was over, the King 'himſelf (OTOO) deſired me to depart; and ſent into the boat different kinds of fruit and fiſh, ready dreſſed *.'

In September, ſame year, Captains COOK and FURNEAUX paid a viſit to OREO, a conſiderable chief in Ulietia, who entertained them with a comedy or dramatic *heava*. 'The muſic,' Captain COOK informs us, 'conſiſted of three drums; the actors were ſeven men, 'and one woman, the Chief's daughter. The only entertaining part 'of the drama, was a theft committed by a man and his accomplice, 'in ſuch a maſterly manner, as ſufficiently diſplayed the genius of 'theſe people in this vice. The theft is diſcovered before the thief 'has

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* Cook's Voyage, 1772, &c. vol. I. p. 156.

‘ has time to carry off his prize; then a ſcuffle enſues with thoſe ſet to ‘ guard it, who, though four to two, are beat off the ſtage, and the ‘ thief and his accomplice bear away their plunder in triumph *.’

Beſide a ſpecies of regular drama, the iſlanders of the Pacific Ocean exhibit, as public amuſements, *wreſtling* and *boxing* matches, which they perform with great ſpirit and dexterity †.

MISCELLANEOUS MANNERS and CUSTOMS obſerved by the South Sea Iſlanders.

AMONG theſe people, when they wiſh to expreſs friendſhip, or at leaſt the abſence of hoſtile intentions, it is a univerſal cuſtom to preſent *green branches of trees* ‡.

In the iſlands of Amſterdam, Middleburg, &c. which have been diſtinguiſhed by the appellation of the *Friendly iſlands*, a very odd cuſtom prevails. It was remarked by our voyagers, that the greater part of the inhabitants, males as well as females, had loſt one or both of their *little fingers*. ‘ We endeavoured,’ ſays Captain COOK, ‘ but in vain, to find out the reaſon of this mutilation; for no one ‘ would take any pains to inform us. It was neither peculiar to ‘ rank, age, or ſex; nor is it done at any certain age, as I ſaw ‘ thoſe of all ages on whom the amputation had been juſt made; ‘ and, except ſome young children, we found few who had both

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* Cook's Voyage, 1772, &c. vol. 1. p. 173. For ſeveral other, but ſimilar dramatic repreſentations and dances, ſee Ibid. p. 295. 307. &c.

† Ibid. p. 349. &c.

‡ Ibid. p. 81.

'hands perfect *.' In Captain **Cook**'s ſecond voyage to theſe iſlands, he diſcovered that this operation is performed when the natives labour under any grievous diſeaſe, and think themſelves in danger of dying; for they imagine that the Deity will accept of the little finger, as a ſacrifice ſufficiently efficacious to procure the recovery of their health †. The ſame cuſtom of cutting off the little fingers, is related by Mr G. **Forster**, who ſailed along with Captain **Cook**. Mr **Forster** thought he diſcovered, that theſe ſtrange mutilations were intended as marks, or remembrancers, of the death of near relations ‡.

Captain **Cook** informs us, that the natives of the *Marqueſas iſlands* are unexceptionably the moſt handſome race of people to be met with in the South Sea. 'For fine ſhape, and regular features, 'they perhaps ſurpaſs all other nations: Nevertheleſs, the affinity 'of their language to that ſpoken in Otaheite and the Society iſles, 'ſhews that they are of the ſame nation. **Oedidee** could converſe 'with them tolerably well, though we could not; but it was eaſy 'to ſee that their language was nearly the ſame. The men are 'punctured, or curiouſly *tattowed*, from head to foot. The figures 'are various, and ſeem to be directed more by fancy than cuſtom. 'Theſe punctuations make them look dark; but the women, who 'are but little punctured, youths, and young children, who are not 'at all, are as fair as ſome Europeans ‖.'

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* Cook's Voyage, 1772, vol. 1. p. 222. The ſame cuſtom prevails in ſome parts of America. See Recherches Philoſophiques ſur les Americains, tom. 2. p. 253.

† Cook's Voyage, 1776, &c. vol. 1. p. 403.

‡ Forſter's Voyage round the World, vol. 1. p. 435. 471.

‖ Cook's Voyage, 1772, &c. vol. 1. p. 308.

In moſt of the South Sea iſlands, it is a general cuſtom, not to ſuffer the women, of whatever rank, to eat in company with the men *.

With regard to the natives of *New Zealand*, their colour varies from a pretty deep black to an olive or yellowiſh tinge. Their faces, in general, are round, with full, though not uncommonly thick lips. Neither are their noſes flat. Their teeth are broad, white, and well ſet; and their eyes are large, and move with great freedom. Their hair is black, ſtraight, and ſtrong. Among the young people, the countenance is generally open and free; but, in moſt of the men, it has a ſerious, and ſometimes a ſullen air. The women are not diſtinguiſhed from the men by many peculiar graces either in form or features. In both ſexes, the dreſs is the ſame, and conſiſts of an oblong garment, about five feet long and four in breadth, made of a ſilky flaxen ſubſtance, which they obtain from a certain ſedgy plant. 'Over this garment,' Captain COOK informs us, 'many of them 'wear mats, which reach from the ſhoulders to near the heels. But 'the moſt common outer-covering is a quantity of the above ſedgy 'plant, badly dreſſed, which they faſten on a ſtring to a conſiderable length, and, throwing it about the ſhoulders, let it fall down 'on all ſides, as far as the middle of the thighs. When they ſit 'down with this upon them, either in their boats or upon the ſhore, 'it would be difficult to diſtinguiſh them from large gray ſtones, if 'their black heads, projecting beyond their coverings, did not engage one to a ſtricter examination †.'

In their heads they fix feathers, or combs made of bone or wood, by way of ornaments. Theſe they adorn with pearl ſhell, or the thin inner ſkins of leaves. Both males and females wear ear-rings compoſed of jaſper, bits of cloth, or beads, when theſe laſt can be procured; and ſome of them have the *ſeptum* of the noſe pierced for the inſertion of ſimilar trinkets. The cuſtom of *tattowing*, or puncturing the face with ſpiral lines and other figures, ſtained with a black or deep blue colour, is likewiſe common. Both ſexes frequently beſmear their heads and faces with a reddiſh ochre, mixed with greaſe; and the women occaſionally wore necklaces of ſharks teeth, or bunches of a kind of long beads, which ſeemed to be made of the leg-bones of ſmall birds.

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* Cook's Voyage, 1772, &c. vol. I. p. 351. *et paſſim.*

† Cook's Voyage, 1776, &c. vol. I. p. 154.

The New Zealanders generally live in caves, in companies of about forty or fifty. They build their huts, which are poor and miſerable dwellings, contiguous to each other. They ſeemed to have no other furniture in theſe hovels than ſome ſmall baſkets or bags, in which they kept their fiſhing-hooks, and other trifles. They ſubſiſt chiefly by fiſhing. For this purpoſe they employ either nets of various kinds, or hooks made of wood, and pointed with bone. Their boats, or canoes, are well built with planks raiſed upon each other, and ſtrongly faſtened with withes. Some of them are fifty feet in length, and ſo broad that they can ſail without the aid of an outrigger. They have no other mode of dreſſing their fiſh than by roaſting, or rather a kind of baking; for they ſeem to know nothing of the art of boiling. When the ſea is too tempeſtuous, they content themſelves, inſtead of larger fiſhes, with muſcles, ſea-ears, and other ſhell-animals which they can procure, in great quantities, upon the rocks and ſea-beach. They indeed breed conſiderable numbers of dogs for eating; but theſe cannot be conſidered as a principal article of their food; for, as there appears not the leaſt mark of cultivation on their ground, they depend chiefly on the ſea for their ſubſiſtence. ‘ Their method of feeding,’ Captain COOK tells us, ‘ correſponds with the naſtineſs of their perſons, which often ſmell ‘ diſagreeably from the quantity of greaſe about them, and their ‘ clothes never being waſhed. We have ſeen them *eat the vermin*, ‘ with which their heads are ſufficiently ſtocked. They alſo uſed ‘ to devour, with the greateſt eagerneſs, large quantities of ſtinking ‘ train oil, and blubber of ſeals, which we were melting at the tent, ‘ and had kept near two months; and, on board the ſhips, they ‘ were not ſatisfied with emptying the lamps, but actually ſwallowed ‘ the cotton, and fragrant wick, with equal voracity *.’—‘ They ‘ ſhew, however,’ continues our author, ‘ as much ingenuity, both ‘ in invention and execution, as any uncivilized nations under ſimilar circumſtances. For, without the uſe of any metal tools, they ‘ make every thing by which they procure their ſubſiſtence, clothing, ‘ and warlike weapons, with a degree of neatneſs, ſtrength, and convenience for accompliſhing their ſeveral purpoſes †.’—‘ Their public ‘ contentions are frequent, or rather perpetual; for it appears, from ‘ their number of weapons, and dexterity in uſing them, that war is ‘ their principal profeſſion ‡.’

When about to attack the enemy, they begin a war-ſong, and raiſe their paſſion to a degree of fury, which is accompanied with a horrible diſtortion of their eyes, mouths, and tongues. All theſe aſſumed dreadful appearances are employed with a view to terrify their enemies; ‘ which,’ ſays Captain COOK, ‘ to thoſe who have ‘ not been accuſtomed to ſuch a practice, makes them appear more ‘ like demons than men, and would almoſt chill the boldeſt with

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* Cook's Voyage, 1776, &c. vol. 1. p. 158. † Ibid. p. 159.

‡ Ibid. p. 161.

'fear. To this ſucceeds a circumſtance, almoſt foretold in their 'fierce demeanour, horrid, cruel, and diſgraceful to human nature; 'which is, cutting in pieces, even before being perfectly dead, the 'bodies of their enemies, and, after dreſſing them on a fire, *devouring the fleſh*, not only without reluctance, but with peculiar ſatisfaction *.'

From this ſhocking picture, we ſhould naturally be led to think that a people of this deſcription muſt be deſtitute of every feeling belonging to humanity; yet, Captain COOK informs us, they lament the loſs of relations and friends with a violence of expreſſion which indicates the moſt tender affection, and the keeneſt regret: 'For,' ſays he, 'both men and women, upon the death of thoſe connected 'with them, whether in battle or otherwiſe, bewail them with the 'moſt doleful cries; at the ſame time cutting their foreheads and 'cheeks with ſhells or pieces of flint, in large gaſhes, until the blood 'flows plentifully, and mixes with their tears.' What is ſtill more characteriſtic of the warm, or rather violent, affections of theſe iſlanders, upon the return of friends who have been for ſome time abſent, they expreſs *joy* by the ſame cuttings as they expreſs *grief* †.

At *Tongataboo*, another of the iſlands in the South Sea, Captain COOK and his aſſociates ſupped with FUTTAFAIHE, one of their Chiefs. 'When ſupper was over,' ſays the Captain, 'abundance 'of cloth was brought for us to ſleep in; but we were a good deal 'diſturbed by a ſingular inſtance of luxury, in which their principal 'men indulge themſelves; that of being beat while they are aſleep. 'Two women ſat by FUTTAFAIHE, and performed this operation, 'which is called *tooge tooge*, by beating briſkly on his body and 'legs, with both fiſts, as on a drum, till he fell aſleep, and continuing

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* Cook's Voyage, 1776, &c. vol. I. p. 161 162.

† Ibid. p. 162.

‘ it the whole night, with ſome ſhort intervals. When once the perſon is aſleep, they abate a little in the ſtrength and quickneſs of the beating; but reſume it, if they obſerve any appearance of his waking [*].’

Among ſavage nations, in general, the men are remarkably harſh and inattentive to the women. They are obliged to perform the dirtieſt and moſt laborious offices. This is, in a peculiar manner, the condition of the fair ſex in the iſland of Tanna. The women carry all the burdens, and the men proceed unconcernedly without any incumbrance, except their arms. ‘It appeared to me,’ ſays Captain COOK, ‘that the women were not held in any eſteem by the men, but obeyed upon the ſmalleſt ſign; and many were ſeen in the humiliating guiſe of drudges and beaſts of burden [†].’

It is not unworthy of remark, that chaſtity, and modeſty, or a deſire of concealing certain actions, which have long been ſuppoſed to be inherent qualities of the human mind, ſeem, from the experience of the voyagers whoſe writings I have ſo often quoted above, to be local ideas only, and totally unknown in a ſtate of uncultivated nature [‡].

Human ſacrifices.—In the iſland of Otaheite, where the general manners of the inhabitants are gentle, obliging, affectionate, and friendly to ſtrangers, it is aſtoniſhing that *human ſacrifices*, on the approach of war with any of the neighbouring iſlands, or other intereſting occaſions, ſhould be a univerſal practice. When ſuch ſacrifices are ordered by their Kings or Chiefs, or Prieſts, the unhappy victims have luckily no intimation of their intended fate. They are pitched upon by the Chiefs, and perſons are appointed to murder them privately. Like many other oppreſſive and unjuſt practices in feudal governments, the victims ſingled out for ſacrifice are always ſelected from the loweſt of the people. This inſtitution ſeems at leaſt to be founded in wiſdom. If they attempted to ſacrifice men in the higher ranks of the ſtate, internal broils and commotions would be unavoidable. After a number of ſuperſtitious rites, and many prayers performed both by the chief and ſubordinate prieſts, the corpſe is at laſt laid upon the moſt conſpicuous part of the *Morai*, or place of worſhip. The prayers and ceremonies were again renewed; and, when theſe were finiſhed, the body was buried in the ground.

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[*] See Cook's Voyage, 1776, &c. vol. 1. p. 323. 344.

[†] Ibid. p. 324.

[‡] See Forſter's Voyage, vol. 2. p. 230. *et alibi paſſim*; and Geneſis, chap. 2. verſe 25. ‘And they were both *naked*, the man and his wife, and were not *aſhamed*.

Beſide human ſacrifices, a practice which is not peculiar to Otaheite, but extends over a great number, perhaps the whole, of the iſlands in the great Southern Ocean, they ſacrifice dogs, hogs, &c. and make offerings of various articles, particularly thoſe of proviſions, to their *Eatooa* or God.

Another circumſtance, recorded by Captain COOK, of the frequency of human ſacrifices in theſe iſlands, muſt not be omitted. 'When 'I deſcribed,' ſays our great and intelligent voyager, 'the *Natibe* at '*Tongabatoo* (another iſland) I mentioned, that, on the approaching 'ſequel of that feſtival, we had been told, that ten men were to be 'ſacrificed. This may give us an idea of the extent of this religi'ous maſſacre on that iſland. And, though we ſhould ſuppoſe, that 'never more than one perſon is ſacrificed on any ſingle occaſion at 'Otaheite, it is more than probable, that theſe occaſions happen ſo 'frequently, as to make a ſhocking waſte of the human race; for I 'counted no leſs than forty-nine ſkulls of former victims, lying be-

'fore the *Morai*, where we ſaw one more added to the number. 'And, as none of theſe ſkulls had, as yet, ſuffered any conſiderable 'change from the weather, it may hence be inferred, that no great 'length of time had elapſed, ſince, at leaſt, this conſiderable number 'of unhappy wretches had been offered on this altar of blood *.'

The human ſacrifice deſcribed above, happened on the 2d day of September 1777; and a ſecond was performed on the 12th of the ſame month. 'This ſecond inſtance,' Captain COOK remarks, 'within the courſe of a few days, was too melancholy a proof, how 'numerous the victims of this bloody ſuperſtition are amongſt this 'humane people †.'

Human ſacrifices, Captain COOK informs us, are more frequent in the Sandwich than in any of the other iſlands. 'Theſe horrid 'rites,' ſays he, 'are not only had recourſe to upon the commencement of war, and preceding great battles, and other ſignal enterpriſes; but the death of any conſiderable Chief calls for a ſacrifice 'of one or more *Towtows*, that is, vulgar or low perſons, according 'to his rank; and we were told, that *ten* men were deſtined to ſuffer on the death of TERREEOBOO ‡,' (a great Chief).

Many other inſtances of this deteſtable practice are mentioned by Captain COOK and other voyagers on the Southern Ocean. That it was, in ancient times, very univerſal among the nations of Europe, we learn from hiſtorians of undoubted authority. From the writings of MOSES, which are perhaps of greater antiquity than any compoſition

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* See Cook's Voyage, 1776, &c. vol. 2. p. 42.

† Ibid. p. 53.; and vol. 3. p. 132, &c.

‡ Ibid. p. 161. Ibid. vol. 1. p. 351. 405.

poſition which has been tranſmitted to us, it appears that human ſacrifices, in all their horrors, were, at that early period, not unfrequent. The ſtory of ABRAHAM about to ſacrifice his only ſon ISAAC, even ſuppoſing it to be allegorical, evinces that the practice was familiar to the people of that country. One paſſage, in this ſtory, is ſo curious, that I cannot refrain from tranſcribing it. 'And they came to the place 'which GOD had told him of, and ABRAHAM built an altar there, 'and laid the wood in order; and bound ISAAC his ſon, and laid 'him on the altar upon the wood. And ABRAHAM ſtretched forth 'his hand, and took the knife to ſlay his ſon. And the angel of the 'LORD called unto him out of heaven, and ſaid, ABRAHAM, 'ABRAHAM; and he ſaid, Here am I. And he ſaid, Lay not thine 'hand upon the lad, neither do thou any thing unto him; for now 'I know that thou feareſt GOD, ſeeing thou haſt not with-held thy 'ſon, thine only ſon, from me *.'

From this paſſage, it is not unworthy of remark, that, in the days of ABRAHAM, when a human ſacrifice was to be offered up, the unhappy victim was ſlain before he was committed to the flames; and that the ſame mode is ſtill obſerved in the iſlands of the Pacific Ocean; with this difference, that, in theſe iſlands, the victims are both ſelected and murdered privately, which renders it impoſſible for them to have any idea of their deſtination; but, from the hiſtory of ABRAHAM and his ſon ISAAC, it appears, that, in the eaſtern countries, the devoted perſons muſt have known their dreadful fate long before the fatal blow was given. The preparatory ſteps were ſhocking to human nature. An altar erected; faggots of wood laid upon the altar; the miſerable wretch bound, and laid upon the wood; and

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* Geneſis, chap. 22. verſe 9, &c.

and the inſtrument by which he was to be butchered preſented to his eyes!

In the Old Teſtament, there are many alluſions to the practice of ſacrificing human beings. In the 18th chapter of Leviticus, verſe 21. we have the following paſſage: 'Thou ſhalt not let any of thy 'ſeed paſs through the fire to Molech *.' Some commentators think, that, by *paſſing through the fire to Molech*, ſignifies a luſtration only, and not an actual ſacrifice. But this idea is completely removed by the Pſalmiſt DAVID †. 'Yea, they ſacrificed their ſons and their 'daughters unto devils, and ſhed innocent blood, even the blood of 'their ſons and their daughters, whom they ſacrificed unto the idols 'of Canaan.' In the prophet HOSEA, we have an unequivocal inſtance of *human ſacrifices* being ſometimes practiſed by the Jews. 'And 'now they ſin more and more, and have made them molten images 'of their ſilver, and idols according to their own underſtanding: 'They were all the work of the craftſmen: They ſay one to another 'whilſt they *ſacrifice a man*, let them kiſs the calves ‡.' The following paſſage in the propheſies of Jeremiah ſhows that this deteſtable practice was not uncommon in the Jewiſh nation: 'And they have 'built the high places of Tophet, which is in the valley of Ben-'hinnom, to burn their ſons and their daughters in the fire ‖.' The ſame prophet, in another chapter, tells us, that 'they have filled 'this place alſo with the blood of innocents, and they have built the 'high places of BAAL, to burn their ſons with fire for burnt offerings 'unto BAAL. Therefore this place ſhall no more be called Tophet,

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* The ſame prohibition is repeated in Deuteronomy, chap. 18. v. 10.; 2d Kings, chap. 16. v. 3.; Ibid. chap. 17. v. 17.; Ibid chap. 23. v. 10.

† Pſalms, chap. 16. v. 37. 38.

‡ Hoſea, chap. 13. v. 2.

‖ Jeremiah, chap. 7. v. 31.

‘ nor the valley of Benhinnom, but the valley of *ſlaughter* [*].’ A ſimilar paſſage occurs in the writings of the prophet EZEKIEL: ‘ Moreover, thou haſt taken thy ſons and thy daughters, whom thou haſt ‘ born unto me, and theſe haſt thou ſacrificed unto *them* (i. e. idols) ‘ to be devoured [†].’ SELDEN likewiſe informs us, that, in Syria, men, women, and children were ſacrificed to the idol *Molech*; and, to prevent the relations of the miſerable victims from hearing their cries while burning in the flames, drums and other loud ſounding inſtruments were employed till their lives were completely extinguiſhed [‡]. The ſame practices were continued among the Carthaginians even in the days of TIBERIUS CÆSAR [‖]. When the Carthaginians were overcome in battle by AGATHOCLES, King of Sicily, they imagined that the gods were angry with them; and, to appeaſe theſe gods, two hundred ſons of the nobles were ordered to be ſacrificed. What exhibits a ſtill ſtronger picture of the barbarous manners and ſuperſtition of theſe people, ſuch noblemen as happened to have no ſons of their own, *purchaſed* boys, for this inhuman purpoſe, from poor people [§].

PLUTARCH informs us, that, in the days of THEMISTOCLES, three young captives were, by his order or conſent, ſacrificed to BACCHUS [**]. It was a practice among the Scythians, ſays HERODOTUS, to ſacrifice to MARS one out of every hundred priſoners taken in war [††]. It does not appear that they eat the fleſh of their enemies, but contented themſelves with drinking their blood [‡‡]. It is not here unworthy of remark, that the Scythians, like the North Americans, ſcalped the heads of thoſe whom they ſlew in battle, and exhibited theſe ſcalps as trophies of valour and proweſs [*]. The Scythians, in making ſolemn treaties, or private covenants, likewiſe drew blood from the veins of the contracting parties, which they mixed with wine, and mutually drank [†].

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[*] Jeremiah, chap. 19. v. 4. 5. 6.

[†] Ezekiel, chap. 16. v. 20. Ibid. chap. 23. v. 37. & 39.

[‡] Selden de Diis Syris, p. 170. 172. 173.; and Schedius de Diis Germanis, p. 401.

[‖] Selden de Diis Syris, p. 182.

[§] Ibid. p. 181.; and De Divin. Inſtit. cap. 21.

[**] Plutarch, edit. Bryan. tom. 1. p. 262.

[††] Herodot. Melpomene, edit. Xyphilin. p. 241.

[‡‡] Ibid. § 64.

JULIUS CÆSAR ſacrificed two young men to the gods in the Campus Martius; which cruel and infamous action was ſolemnly performed by the Roman prieſts [‡]. The ancient Greeks were accuſtomed to flatter or appeaſe their god SATURN by human ſacrifices. The ſame horrid practice was uſual among the Carthaginians, while their ſtate ſubſiſted; and DIONYSIUS tells us, that, in his time, the cuſtom prevailed ſtill among the Gauls and other nations in the weſt of Europe. But HERCULES is ſaid to have aboliſhed this inhuman rite, by ſubſtituting the figures and dreſs, inſtead of the perſons, of the intended victims; and perſuaded the people, that the offended gods would be equally pleaſed with the ſhadow as with the ſubſtance [‖]. This mode of ſacrificing figures, inſtead of men, with a few exceptions, was long continued among the Romans [§]. PLINY relates [**], that, in the year of Rome 657, when CN. CORNELIUS LEPIDUS and P. LICINIUS CRASSUS were conſuls, a decree of the Senate paſſed, forbidding all human ſacrifices for the future; a clear indication that this deteſtable rite was formerly not unfrequent in that great empire.

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[*] Herodot. Melpomene, edit. Xyphilin, p. 241.

[†] Ibid. p. 243. § 70.

[‡] Dio Caſſius, lib. 43. p. 140. edit. Xyphilin.

[‖] Dionyſ. Halicarnaſſ. edit. Sylburg. p. 30.

[§] Id. ibid.

[**] Plin. lib. 30. c. 1.

The Druids, we are told by STRABO, inſtead of taking victims from the brute creation, ſacrificed individuals of the human ſpecies. When a man was pitched upon for the purpoſes of divination, they ſtabbed him with a poinard; and, from the various contortions and convulſive motions produced by extreme agony, the monſters called *prieſts*, pretended to predict future events *. He likewiſe informs us, that the Cimbri, after diſſecting the bellies of their captives, from the appearance of the inteſtines, foretold victory or defeat †. TACITUS, in his Annals, ſays, that the Druids, on altars erected in groves, ſacrificed Tribunes and Centurians of the firſt rank ‡. He adds, that they conſulted the gods by the diſpoſition of the fleſhy fibres of human victims ‖. JULIUS CÆSAR, when deſcribing the manners of the Gauls, remarks, that they were extremely religious; that, when afflicted with grievous diſeaſes, or other calamities, they either ſacrificed human victims, or ſpontaneouſly devoted themſelves to that terrible mode of extinguiſhing life. The Druids, or prieſts, ſuperintended theſe ſacrifices, which were performed with a view to expiate their crimes, and to appeaſe the wrath of their gods. In their more public ſacrifices of this kind, they employed immenſe images of men, compoſed of the branches of trees. Theſe images were hollow within; and the legs, thighs, trunk, and arms, were filled with men, women, and children, who were all burnt with faggots from below. This was the puniſhment of thoſe who had been guilty of theft, or other crimes. But, when a ſufficient number of criminals could not be obtained, recourſe was had to thoſe who were perfectly innocent §.

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* Strab. lib. 4.

† Id. lib. 7. de Cimbris.

‡ Tacit. Annal. lib. 1.

§ Ibid. lib. 14. and de Moribus German.—See alſo Lucan. Pharſal. lib. 3.

‖ Jul. Caeſ. Opera, edit. Samuel Clarke, S. T. fr. lib. 6. p. 131.

In Mexico, when that empire was diſcovered by the Spaniards, they had a complete ſyſtem of religious opinions and practices, accompanied with all the uſual train of prieſts, temples, victims, and feſtivals. But, of all offerings to their gods, human ſacrifices they conſidered as the moſt acceptable. The captives taken in war were brought to the temple, devoted as victims to their divinities, and ſacrificed with rites the moſt ſolemn and excruciating. The heart and head were conſecrated to the gods; and the reſpective warriors who ſeized the priſoners carried off the bodies to *feaſt* upon them with their friends *. The ſame author, in another place, tells us, that the Spaniards landed on a ſmall iſland, which they called the *Iſle of Sacrifices*; becauſe there, for the firſt time, they beheld the horrid ſpectacle of human victims †. Even among the Peruvians, who, of all the people found in America when firſt diſcovered, were the mildeſt and moſt humane in their general temper and manners, on certain emergencies, offered human ſacrifices to their god. On the death of an Inca, or other perſon of rank, many of their attendants were killed, that they might appear in the other world with their uſual retinue, and be ſerved with the ſame reſpect as they had been in this. On the death of HUANA-CAPAC, the moſt powerful of their Monarchs, more than a thouſand human victims accompanied him to the tomb ‡. The ſame practice was obſerved by the natives of Florida, where the lives of the ſubject were at the abſolute diſpoſal of the Sovereign. When any of his ſubjects incurred his diſpleaſure, they approached him with the moſt abject humility, and offered him their heads. Neither did this abſolute dominion terminate with the death of the Sovereign. When that event happened, his favourite wives and domeſtics were ſacrificed at his tomb, that he might appear with his uſual pomp in the next world; and, ſuch was the abſurd reverence in which he was held, that thoſe victims met death with exultation, eſteeming it as a mark of diſtinction, and a reward for their fidelity *.

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* Robertſon's Hiſtory of America, and the authorities quoted by him, vol. 2. p. 302. &c.

† Ibid. vol. 1. p. 242.

‡ Ibid. vol. 2. p. 325.

I muſt here quote a few lines from Dr ROBERTSON's Hiſtory of America, as it ſtrongly marks the character and manners of the Tlaſcalans, who ſtrenuouſly oppoſed the Spaniards in their progreſs to Mexico. 'They gave the Spaniards warning,' ſays that elegant hiſtorian, 'of their hoſtile intentions; and, as they knew that they 'wanted proviſions, and imagined, perhaps, like the other Ameri'cans, that they had left their own country becauſe it did not afford 'them ſubſiſtence, they ſent to their camp a large ſupply of poultry 'and maize, deſiring them to eat plentifully, becauſe they *ſcorned* 'to attack an enemy *enfeebled* by hunger, and it would be an *affront* 'to their *gods* to offer them *famiſhed* victims, as well as diſagree'able to themſelves to *feed* on ſuch *emaciated prey* †.' The Americans conſidered the Spaniards as ſuperior beings. CORTES, their then leader, with a moſt impolitic cruelty, and a moſt diabolical ingratitude, ſeized fifty Tlaſcalans, who brought proviſions to his camp, and, on the ſuppoſition that they were ſpies, cut off their hands. This horrible ſpectacle, joined to the terror excited by firearms and horſes, gave dreadful impreſſions of their ferocity, as appears from their mode of addreſſing the Spaniards. 'If,' ſaid they, 'you are *divinities* of a cruel and ſavage nature, we preſent to you '*five ſlaves*, that you may *drink* their *blood*, and *eat* their *fleſh*. If 'you are mild *deities*, accept an offer of incenſe and variegated 'plumes. If you are *men*, here is meat, and bread, and fruit to 'nouriſh

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* Robertſon's Hiſtory of America, and authorities, vol. 1. p. 344. 380.

† Ibid. vol. 2. p. 40.

'nouriſh you *.' Cholula, a town of ſome extent in the empire of Mexico, was conſidered by the inhabitants of New Spain as the ſanctuary and chief reſidence of their gods. To this town pilgrims reſorted from all the provinces, and a greater number of *human victims* were offered in its principal temple than even in that of Mexico †.

When **Cortes** and his army had made themſelves maſters of part of the city of Mexico, they were almoſt totally overpowered by the numbers and the fierceneſs of their enemies. Beſide thoſe who were ſlain, forty Spaniards were taken priſoners. The Mexicans celebrated their victory with a horrid feſtival. The city was illuminated, and particularly their great temple. By means of the lights, the Spaniards diſtinguiſhed their companions by the whiteneſs of their colour, when compelled to dance naked before the image of the Mexican god, to whom they were about to be ſacrificed. They heard diſtinctly the ſhrieks of thoſe who were *ſacrificed*, and thought they knew the voice of each unhappy *victim* ‡.

The Germans and Celts, after ſacrificing *men* and dogs, ſuſpended the dead bodies in the ſacred groves, ſprinkled their blood on the adjacent trees, on their idol, and on the ſpectators. They afterwards *feaſted* on the *fleſh* of the victims ‖. Among the ſame people, a god, either ſupreme, or of the higheſt order, was always honoured with the moſt important ſacrifices, as that of an *only ſon* §.

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* Robertſon's Hiſtory of America, vol. 2. p. 42. † Ibid. p. 47.

‡ Ibid. p. 119. 120.

‖ Snorro Sturleſonius, in vita Haguini Adeſtani; and Keyſler, Antiquitat. Septentrional. et Celtic. p. 326. 327.

§ Tacitus, Delphin. p. 121. &c.

Human ſacrifices, even in the days of PLATO, were not unfrequent in almoſt every diſtrict of Greece [*]. The goddeſs DIANA was ſuppoſed to be incenſed, becauſe MELANIPPUS and COMETHO were married in her temple on the very night of a feſtival. The oracle, upon this momentous occaſion, was conſulted; and the reſponſe was, that, to appeaſe her godſhip, a *boy*, and a *girl* of the greateſt *beauty*, ſhould be annually ſacrificed [†]. To a ſtatue of ſome barbarous divinity, ſaid to have been brought from Taurica to Lacedemon, the oracle commanded that *human ſacrifices* ſhould be offered. But LYCURGUS aboliſhed this horrid rite [‡]. PELOPIDAS, when his ſituation in war was critical, dreamed that the favour of the gods muſt be obtained by *ſacrificing* a young *virgin*. Some of his generals inſiſted that the will of the gods ſhould be implicitly obeyed. But others oppoſed the perpetration of a deed ſo ſhocking and unnatural. While, ſays PLUTARCH, the Chiefs were diſputing upon this more than brutal ſubject, and PELOPIDAS himſelf was heſitating, a young *mare*, leaving her paſture, ran towards the camp. THEOCRITUS, the ſeer, inſtantly called out to PELOPIDAS: Behold the victim the gods have prepared for you, and they expect no other *virgin!* The mare, with the uſual ſolemnities, was immediately ſacrificed [‖]. It is impoſſible not to recollect the ſimilarity of this event to that of ABRAHAM and his ſon ISAAC. A *mare* and a *ram* make no conſiderable variation in the two ſtories.

The Semnones, a people in the circle of Saxony in Germany, held their religious rites and public deliberations in ſacred groves;

and,

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[*] Plato de Legib. lib. 6.; and Travels of Anacharſis, the younger, in Greece, vol. 2. p. 348. Tranſ.

[†] Pauſan. lib. 7. cap. 16.

[‡] Ibid. lib. 3. cap. 16.

[‖] Plutarch, vol. 2. edit. Bryan. p. 222.

and, before they came to any determination of moment, they ſacrificed a *man* to their gods *. **PLUTARCH**, on this ſubject, laughs at the Romans for reprehending the Barbarians, becauſe the latter were addicted to human ſacrifices, a deteſtable practice of which the former were not unfrequently guilty †.

We meet with a ſhocking inſtance of *human ſacrifices* in the reign of **AUGUSTUS**. After L. **ANTONIUS** was obliged to ſurrender at Peruſia, **AUGUSTUS** commanded no leſs than four hundred ſenators and Roman knights, who had taken part with **ANTONY**, to be *ſacrificed* as *victims* at the altar of **JULIUS CÆSAR** ‡. The ſame fact is mentioned by **SUETONIUS**, with this only exception, that he reduces the number of victims to three hundred ‖.

Even in the days of **PROCOPIUS**, who was one of **JUSTINIAN**'s generals, the Gauls abſurdly ſacrificed *human* victims after the *Chriſtian religion* was eſtabliſhed in their country §; and **DITMARUS** tells us, that the Normans and Danes ſacrificed annually *ninety-nine men*, along with a number of other animals **. **TACITUS** relates, that **MERCURY** was the chief god of the Germans, and that, on certain ſtated days, *human ſacrifices* were offered up to him ††.

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* Tacit. de Moribus German. edit Delphin. tom. 4. p. 119.

† Plutarch. de Superſtitione.

‡ Dio Caſſ. edit. Xiphilin. lib. 48. p. 225.

‖ Suetonius in vit. Caeſar. Octavian. Auguſt. § 14.

§ Procop. de Bello Goth. lib. 1.

** Ditmar. lib. 1.

†† Tacit. edit. Delphin. tom. 4. p. 29.

What, in the name of wonder, ſhould have given riſe to an inſtitution ſo apparently contrary to every principle of human nature, and yet ſo univerſally diffuſed over the whole globe? That it originated from ſuperſtition is unqueſtionable. But that anſwer is too general. There muſt be a progreſs in ſuperſtition, as well as in every other acquired affection of the mind. Whenever men, (which muſt have been coeval with their exiſtence), acquired ideas of ſuperior powers, they aſcribed to them human paſſions, and human frailties. If they imagined that, by any action, they had incurred the diſpleaſure of a particular god, or powerful being, terror was the inevitable conſequence. The next feeling was, how is this angry god to be appeaſed? It was not an unnatural thought, that ſuch articles of proviſions as were agreeable to themſelves would not be unacceptable to their gods. They accordingly began with offerings of their choiceſt fruits. But, after a prieſthood was eſtabliſhed, it was ſoon diſcovered that ſuch ſimple offerings were not ſufficient. They taught the people, that the gods liked more ſubſtantial food. The animal tribes were the next objects of propitiation for ſin. This new object was particularly agreeable to the prieſts, who in all ages were fond of good eating. They at firſt contented themſelves with ſacrificing and devouring the feathered tribes, ſuch as turtle-doves, cocks, &c. This anſwered very well for ſome time; but ſtill it was not enough. As the number of prieſts gradually increaſed, birds alone were not thought to be ſufficient to ſupport them. They, therefore, had recourſe to the quadrupeds; becauſe the ſins of the land were ſtill increaſing, in proportion to the increaſe of population. Hence they proceeded to ſacrifice lambs, kids, hogs, rams, and goats. Not ſatisfied ſtill, the prieſts inſiſted that the people, in order to avert the vengeance of the gods, and procure pardon for their numerous and complicated iniquities, ſhould feaſt them with heifers, bullocks, and oxen. Theſe prieſts, it ſhould appear, after tiring of birds and the ſmaller quadrupeds, like honeſt Engliſhmen, at laſt gave the preference to good roaſt-beef.

This ſacrifical progreſſion has not hitherto been unnatural. But the ſtep from quadrupeds to the human ſpecies is very wide; yet there are many recorded inſtances, in almoſt all nations whoſe ancient hiſtory has come down to us, of this diabolical practice; and we have ſeen that it ſtill exiſts in moſt of the iſlands of the Pacific Ocean which have been viſited by our late navigators. Here the theory of feeding prieſts may ſeem to fail; but it muſt not be entirely relinquiſhed. In the rude ſtages of ſociety, Cannibals, or eaters of human fleſh, have, at different periods, been diffuſed over the whole habitable globe. Superſtition, or rather ſomething more groſs, muſt have given riſe to an action ſo generally repugnant to human nature. The dreadful inſtitution of murdering and roaſting men, with a view to appeaſe the wrath of the gods, was ſoon ſucceeded by eating their fleſh. When this was perceived by rude and often ſtarved barbarians, the prieſts, or ſuperintendants of ſuch deteſtable rites, preferred men to all other animals. This motive could not be held out to the people. To them a more powerful engine was exhibited. Upon particular emergencies, when their minds were in the higheſt agitations of terror, whether from real or ſuperſtitious cauſes, the poor deluded creatures were told, that the reſentment and wrath of the gods were ſo great, that neither birds nor quadrupeds, nor any of the inferior animals, would be effectual to avert their vengeance. There was only one ſtep farther. Inſtead of birds and quadrupeds, nothing leſs than individuals of the human ſpecies could appeaſe theſe inſatiable gods, the exiſtence of whom was firmly believed by ignorant men, and ſtrongly inculcated by wicked prieſts.

Pelew or Palos Iſlanders.

We now willingly abandon the ſhocking ſubjects of cannibals and human ſacrifices, and ſhall proceed to give a more agreeable picture of man in a ſtate not more enlightened by ſcience than ſome of the various people which have already been curſorily deſcribed.

The Pelew or Palos iſlands are ſituated between the 5th and 9th degree of north latitude, and between the 130th and 136th degrees of eaſt longitude from Greenwich, and ſeem never to have been viſited by any European till Captain Henry Wilson, of the *Antelope Eaſt-India packet*, was wrecked on one of their ſhores in the year 1783. Captain Wilson and his ſhip's company, after this diſaſterous event, were apprehenſive leſt the natives ſhould prove to be hoſtile. They, however, diſcovered, that this iſland, the name of which they afterwards learnt to be *Oroolong*, was without inhabitants, but ſurrounded with a group of other iſlands crowded with people. The day after the wreck, two canoes appeared, and were approaching to Oroolong. Every man immediately ran to his arms, which, with a quantity of powder and ſhot, had been ſaved, in order to repel any attack that might be made. Theſe canoes came near the ſhore. Captain Wilson, and Thomas Rose, a native of Bengal, who underſtood the Malay and ſeveral other languages, addreſſed the people in the boats, one of whom ſpoke the Malay tongue. They aſked, Who the Antelope's men were, and whether they were friends or foes? To this queſtion Thomas Rose was directed to reply, That they were unfortunate Engliſhmen, who had loſt their ſhip upon the reef; that they were friends, and had no inimical intentions; but that they relied on ſuch aſſiſtance from the natives as men in their calamitous ſituation required. They then came aſhore; and, as was natural, they looked around with a jealous eye, leſt they ſhould be ſurpriſed and injured. The courteous and ffectionate manner with which Captain WILSON and the other gentlemen treated them, ſoon removed all their apprehenſions.

The natives of theſe iſlands are of a deep copper colour, and go perfectly naked. They are of a middling ſtature, very erect and muſcular; their limbs are handſome; and they have a peculiar majeſty in their manner of walking. Theſe people came from *Pelew*, the capital of a neighbouring iſland, governed, along with others, by ABBA THULLE, their King or Sovereign, to Oroolong. Their legs as well as thighs were ſo thickly *tattooed*, that their colour was much deeper than that of the reſt of their bodies. They ſeemed to have never known or heard of white men; and therefore conſidered the Engliſh as a very extraordinary race of beings. They were aſtoniſhed to find that the Engliſh allowed hair to grow on their breaſts, which they regarded as a mark of great indelicacy; and, therefore, both ſexes eradicate the hairs from every part of their bodies, except the head. At the firſt interview with King ABBA THULLE, Captain WILSON requeſted permiſſion to build a veſſel to convey himſelf and his unfortunate aſſociates back to their own country; a requeſt to which the King moſt courteouſly aſſented, and promiſed every aſſiſtance in his power to render their diſtreſsful ſituation as comfortable as poſſible. This King, like his ſubjects, was perfectly naked, and, in his perſon, had not the ſmalleſt mark of diſtinction, except what aroſe from his good ſenſe, humanity, and deportment. Theſe innocent people were totally ignorant of fire-arms. Captain WILSON, in order to gratify their curioſity, ordered all his men to be armed and drawn up on the beach. After going through ſome evolutions, they fired three vollies in preſence of the King and his attendants, who expreſſed their ſurpriſe by hallowing, jumping, &c. One of the fowls, which had been ſaved from the wreck, was made to paſs acroſs the cove, where Mr BENGER was prepared with his fowling-piece loaded with ſmall ſhot. He fired, and the bird inſtantly dropped, having one wing and one leg broken. Some of the natives took it up, and brought it to the King, who was aſtoniſhed, as he had ſeen nothing paſs out of the gun, how this effect could have been produced.

Some time after, Captain WILSON, and the whole ſhip's company were vexed, and even alarmed, on obſerving an unuſual coolneſs in the aſpect and behaviour of the King. Inſtead of his former open and affectionate manner, he had become moroſe and apparently diſtruſtful. The cauſe of this change, however, when developed, was not only a confirmation of the higheſt honour in the breaſt of the Sovereign, but a proof of the greateſt delicacy of ſentiment. The King was at war with an iſland not far diſtant, called *Artingall.* He meant to make an attack upon that iſland in a few days. He wiſhed to have the aſſiſtance of five Engliſhmen armed with muſkets, piſtols, &c. to aſtoniſh and annoy his enemies. Whenever Captain WILSON diſcovered the nature of the King's requeſt, he inſtantly complied. In a moment, every countenance aſſumed an unuſual gaiety, and perfect harmony and mutual confidence were reſtored. The five men, with THOMAS ROSE the interpreter, accompanied the fleet of King *ABBA THULLE*, which conſiſted of a hundred and fifty canoes filled with warriors. No ſooner did they arrive within a proper diſtance of the enemy's fleet than the muſketry were ordered to be fired. One or two men were obſerved to fall. Terror and diſmay, at an exhibition ſo far removed from the conception of thoſe iſlanders, inſtantly ſeized them, and they fled with the utmoſt precipitation. The King, elevated by the victory he had ſo eaſily obtained, and the terror which he had excited in the minds of his enemies, returned in triumph to his own dominions, where he was received by his ſubjects with every mark of joy and exultation. Some little time afterwards, the King prepared his canoes and ſoldiers for another expedition againſt Artingall. Ten Engliſhmen, armed as before, with the addition of a ſwivel-gun, were ſolicited from Captain WILSON to attend *ABBA THULLE* and his warriors. This requeſt was alſo granted; and the havock made by the fire-arms was ſo great, that another victory was eaſily obtained by the Monarch of Pelew. Soon after this defeat, peace was concluded between the two contending parties.

Marriage, among theſe people, ſeemed to be a civil contract, which they regard as inviolable. A plurality of wives was allowed, though the number ſeldom exceeded two. *RAA ROOK* had three wives, and the King five; but they did not live together. After a woman was pregnant, though ſhe accompanied her huſband, ſhe never, while in that ſtate, ſlept with him. When any Chief appeared with his two wives, they generally ſat on each ſide of him; and the company paid no more attention to them than what is cuſtomary where the greateſt good manners prevail. One of the Engliſh gentlemen, endeavouring to render himſelf agreeable to a lady by what is uſually termed a marked aſſiduity, *ARRA ROOKER*, with much delicacy, hinted, that ſuch behaviour was not altogether proper.

With regard to their mode of *burying* the dead, Mr SHARP the ſurgeon, and THOMAS HARVEY the boatſwain, ſaw the funeral of

Raa Rook's ſon, who had fallen in battle. The body was wrapped in a mat, and carried on the ſhoulders of four men, on a machine made of bamboos, and reſembling what is called a *horſe* by our chairmen. Beſide theſe four bearers, the funeral proceſſion conſiſted entirely of women, who inceſſantly ſet up the loudeſt lamentations. The ſame cuſtom formerly exiſted in the north of Scotland, and ſtill prevails in ſome parts of the Highlands and weſtern iſles of that country.

Captain Wilson and his ſhip's company, before their new veſſel could be fitted for ſea, remained three months in Oroolong, and occaſionally viſited ſeveral other of the Pelew Iſlands. During this period they could diſcover no marks of a public *religion* of any kind among theſe iſlanders: But they uniformly exhibited the greateſt examples of *humanity* and *moral rectitude*, which ought to be the genuine characteriſtics of all religions, whatever diverſity of ceremonials they may happen to aſſume. But, though theſe people have no place of *public* worſhip to which they reſort, both their private and political virtues are ſo eminently conſpicuous, that it is almoſt impoſſible they ſhould not have ſome idea of a ſupreme and a benevolent Deity. The people of Pelew, however, diſcovered ſome portion of ſuperſtition; for, when King *Abba Thulle* ſaw a particular ſpecies of *wood* employed in the conſtruction of the new ſhip, he expreſſed a wiſh that this wood ſhould be removed, as he conſidered it as a *bad omen*, or *unpropitious*. They had likewiſe a notion of an evil ſpirit, that often counteracted human affairs. When the ſecond mate, Mr *Barker*, fell backward from the ſide of the veſſel then on the ſtocks, *Raa Rook*, who happened to be preſent, ſaid, the accident was owing to the *unlucky wood*, which had been allowed to remain in the veſſel, that the evil ſpirit had brought this misfortune upon Mr *Barker*.

They ſeemed to have alſo a ſtrong notion of divination. When about to undertake any affair of moment, by ſplitting the leaves of a plant ſimilar to our bullruſh, and meaſuring or twiſting theſe ſtrips upon their middle finger, they imagined they could diſcover whether the event would be proſperous or adverſe. *Captain WILSON*, in converſation with *LEE BOO*, King *ABBA THULLE's* ſecond ſon, after his arrival in England with the Captain, told him, that the intention of ſaying prayers at church was in order to make men good, and that, when they died, and were buried, they might live again *above*, pointing to the ſky; *LEE BOO*, with great eagerneſs, replied—*All ſame PELEW—Bad men ſtay in earth—good men go into ſky—become very beautiful*, holding his hand in the air, and giving a fluttering motion with his fingers. This ſingle circumſtance indicates, in the moſt unequivocal terms, that theſe innocent people firmly believe the exiſtence of the ſoul after the diſſolution of the body, and have an idea of future rewards and puniſhments correſponding to the virtuous or vicious behaviour of individuals.

It is a ſingular circumſtance in the hiſtory of theſe people, that, if an *attack* is intended againſt an *hoſtile* iſland, inſtead of ſurpriſing the enemy, intimation is uniformly given of the time when the aſſault is to be made. Though illuſtrious patterns of humanity, they put to *death* every *priſoner* taken in *war*. This ſeeming cruelty, however, muſt not be haſtily condemned. It is not performed with the inſulting ſolemnities of ſeemingly *legal trials*, like the execrable conduct of the preſent *French Convention*, which will for ever remain a moſt deteſtable and humiliating proof of the *barbarity* of what has, till now, been eſteemed one of the moſt *civilized* nations in Europe. The Pelew Iſlanders, on the contrary, never kill their priſoners but inſtantly after a victory is obtained, before the effervеſcence of animoſity is allayed; and the poor victims are deprived of life by thoſe who are either ſmarting under *perſonal* wounds, or who have loſt ſome near *relation* in the combat.

It has formerly been related, that the inhabitants of the South Sea Iſlands are addicted to *petty thefts*. In the *Pelew* Iſlands inſtances of theft likewiſe occurred; but this *crime*, if in them it merits that appellation, was always confined to the lower claſs of people. When a theft, however, was committed, the King and his Chiefs conſidered it as a groſs breach of hoſpitality, made ſtrict inquiries after the thief, whom they generally diſcovered, and reſtored the articles. 'Should 'ſome eaſtern prince,' Captain WILSON humanely remarks, as an apology for the Pelewers, 'magnificently decorated, accidentally, as he 'paſſed along, drop a diamond from his robe, and were a poor pea'ſant (knowing how great an acquiſition it was), to ſee it ſparkling 'in the duſt, where is that reſiſtance, that ſelf-denial, which would 'go in and leave it untouched?—A nail, a tool, or a bit of old iron, 'was to *them* the alluring diamond.'

We muſt not leave theſe amiable people, till a ſhort ſketch of the character and feelings of LEE BOO, who was brought from Pelew to England by Captain WILSON, ſhall be given. This young Prince was about twenty years of age when he arrived in a *New World*. His natural diſpoſition was mild, affable, ſprightly, and affectionate. He diſcovered, on all occaſions, a keen ſpirit of inveſtigating the cauſes or effects which to him were at firſt incomprehenſible. After landing at Macao, he was conducted, along with his protectors and friends, to the houſe of Mr M'INTYRE, and brought into a large hall, which was lighted with candles, a table being placed in the middle covered for ſupper, and a ſideboard handſomely ornamented.

This new ſcene filled Lee Boo's mind with amazement. But the glaſs-veſſels ſeemed principally to arreſt his attention. He fixed his eye upon a large mirror, which nearly reflected his whole body. Here he ſtood ſome time loſt in aſtoniſhment. He then laughed, drew back, and, abſorbed in wonder, returned to view this ſtrange appearance. He looked, as young children, when placed in the ſame circumſtances, uniformly do, behind the mirror, to ſee if any perſon was there. As there were no quadrupeds in his country, except two dogs which had been left there by the Engliſh, the ſheep, goats, and cattle he ſaw at Macao, were objects which ſtruck his mind in the moſt forcible manner. One of the dogs left at Pelew was a Newfoundlander, and his name was *Sailor*. Lee Boo, from this circumſtance, denominated every quadruped he ſaw, whether ſmall or great, *Sailor*. A horſe was a *large ſailor*, &c. Obſerving a man paſs the houſe on horſeback, he was ſo aſtoniſhed, that he preſſed every perſon in company to go and ſee ſo ſtrange a phaenomenon.

When on his voyage to England in the Morſe indiaman, Captain Elliot, he was very deſirous of learning the name and the country of every ſhip that paſſed. As each inquiry was gratified, he made an additional *knot* on his *line*. Theſe *knots* were to him the ſame as written memorandums to us. But, as the knots ſoon became numerous, to refreſh his memory, he was obliged to read them over every day. The officers of the Morſe, when they ſaw him ſtudying his *line*, uſed to ſay he was *reading* his *journal*. He ſollicited Captain Wilson to be inſtructed in the uſe of letters and of reading, which was readily acquieſced in; and he was very attentive and alert in comprehending every ſpecies of information he received. On arriving at St Helena, he was much ſtruck with the ſoldiers and cannon on the fortifications. When walking in the Company's garden, he was pleaſed with ſome ſhady walks formed with bamboos arching overhead on lattice-work; and remarked that his own countrymen were ignorant of many advantages they might eaſily obtain. Like a philoſopher and patriot, every uſeful and extraordinary thing that occurred in his travels, he noted down in his manner, and with the uniform view of improving his countrymen when he ſhould return to his native ſoil. The Morſe arrived at Portſmouth on the 14th day of July 1784. When LEE BOO landed, the number and magnitude of war ſhips in the harbour, the variety and ſtructure of the houſes, and the ramparts, ſo rivetted and abſorbed his mind, that he found himſelf unable to aſk any queſtions. When he reached London from Portſmouth, he was conveyed to Captain WILSON's houſe at Rotherhithe. He arrived in his natural glow and youthful ſpirits. What he had remarked in ſilence, was now diſcloſed with vivacity and intelligence. He deſcribed the incidents of his journey, and ſaid that it was very pleaſant; that he had been put into a little *houſe*, which was run away with by *horſes*; that he ſlept, but was ſtill proceeding in his journey, and that, whilſt he was moved one way, the *fields*, the *houſes*, and the *trees*, went in the contrary direction. At the hour of reſt, he was conducted to his chamber, where, for the firſt time, he ſaw a fourpoſt bed. Not knowing for what purpoſe it was intended, he repeatedly jumped in and out, and felt and pulled aſide the curtains. At length, being acquainted with its uſe, he laid himſelf down to ſleep, ſaying, that, in England, there was *a houſe for every thing*. Being aſked his opinion of England and of his preſent ſituation, he inſtantly replied, *All fine country, fine ſtreet, fine coach, and houſe upon houſe up to ſky.*

LEE BOO was ſent to an academy, to be inſtructed in reading and writing. Whilſt there, his manner and deportment ſoon gained him the eſteem of the maſter, and the affection of his young companions. In the hours of receſs from ſchool, he amuſed Captain WILSON's family with his vivacity and good humour. He mimicked ſuch peculiarities as he obſerved in the manners and behaviour of his ſchoolfellows, and often ſaid, that, when he returned to *Pelew*, he would have a ſchool of his own, and ſhould be thought very wiſe *when he taught the great people their letters.* He always called Mr WILSON *Captain;* but he uniformly gave the appellation of *Mother* to Mrs WILSON, conſidering it as a greater mark of affection and reſpect. He was often told, that he ſhould ſay *Mrs WILSON;* but his conſtant reply was, *No, no—Mother, Mother.* When ſollicited for charity by *young* people of either ſex, he told them, that it was ſhameful to *beg* as long as they were able to *work;* but the ſollicitations of *old age* he could never reſiſt, ſaying to himſelf, LEE BOO *muſt give poor old man—old man not able to work.* Captain WILSON and the young Prince, when dining with Mr KEATE, a friend of Mr WILSON, and well known to LEE BOO, a miniature picture of Mr KEATE was exhibited; LEE BOO, taking the picture into his hand, inſtantly recognized the likeneſs, and exclaimed, *Miſſer* KEATE—*very nice, very good.* Captain WILSON aſked him, if he underſtood what it repreſented? He replied, LEE BOO *underſtand well—That Miſſer* KEATE *die—This Miſſer* KEATE *live!* A volume on the utility of portrait-painting could not contain more than theſe few forcible words uttered by this untutored child of Nature.

Every uſeful or uncommon object which he ſaw he examined with attention, and, like a true philoſopher and patriot, conſidered whether it might be rendered uſeful to his own country. When in gardens, he remarked particularly the eſculent plants and fruit-trees, aſked many queſtions concerning them, and ſaid that, when he returned home, he would carry ſeeds of ſuch of them as he thought would grow to perfection in *Pelew.* While rapidly advancing in the knowledge of the Engliſh language, and in the art of writing, notwithſtanding all the precautions of his friends, he was ſeized with the ſmall-pox, of which he died in a few days. When very bad, he accidentally heard that Mrs WILSON was indiſpoſed, and confined to bed, he became impatient, and exclaimed, *What, mother ill?* LEE BOO *go up to ſee her.* On the Thurſday before his death, when walking acroſs the room, he looked at himſelf in the glaſs. His face being then ſwelled and disfigured, he ſhook his head, turned away as if diſguſted with his appearance, and ſaid to Mr SHARP the ſurgeon, that *his father and mother much grieve, for they knew he was very ſick.* Growing worſe in the evening, he ſeemed to think himſelf in danger. He took Mr SHARP by the hand, and looking ſtedfaſtly on him, ſaid, *Good friend, when you go to* PELEW, *tell* ABBA THULLE *that* LEE BOO *take much drink to make ſmall-pox go away, but he die; that the Captain and mother very kind—all Engliſh very good men;—was much ſorry he could not ſpeak to the King the number of fine things the Engliſh had got.* Though his feelings and pain muſt have been acute, his ſpirit would not allow him to complain. Mrs WILSON's chamber being adjacent to his own, he often called out to know if ſhe was better, always adding, leſt ſhe ſhould ſuffer on his account, LEE BOO *do well, Mother.* Soon after his interment in Rotherhithe church-yard, the INDIA COMPANY ordered a tomb to be erected over his grave with the following inſcription:

To the Memory
Of Prince LEE BOO,
A native of the PELEW, or PALOS Iſlands;
And ſon to ABBA THULLE, Rupack or King
Of the Iſland COOROORAA;
Who departed this life on the 27th of December
1784,
Aged 20 years;
This Stone is inſcribed,
By the Honourable United Eaſt India Company,
As a Teſtimony of Eſteem
For the humane and kind Treatment afforded
By his FATHER to the Crew of their ſhip
The ANTELOPE, Captain WILSON,
Which was wrecked off that Iſland
In the night of the 9th of Auguſt 1783.

Stop, Reader, ſtop!—let NATURE claim a tear—
A Prince of MINE, LEE BOO, lies buried here.

Upon the whole, no poet, either for character, ſituation, or incident, can have a better ſubject for a *Tragedy*, than is afforded by the *Hiſtory of Prince* LEE BOO *.

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* This ſhort narrative concerning the Pelew iſlanders is extracted from *An Account of the Pelew Iſlands, compoſed from the Journals of Captain* HENRY WILSON, *and ſome of his officers, by the ingenious* GEORGE KEATE, *Eſq;* F. R. S. & S. A.

THIS intereſting Chapter muſt not be concluded without ſome general reflections. The reader has now been conducted through almoſt every region of the globe which has hitherto been viſited by Europeans of intelligence. Though, in different climates, men vary in colour, appearance, and manners; yet the human character, however diverſified, is not only recognizable, but perceived to be uniformly and diſtinctively the ſame. It is not by colour, nor even form, but by mental powers, that men riſe ſuperior to all other animated beings in this planet.

RELIGION.

IN every country, however remote from civilization, traces of RELIGION, or of *ſuperſtition*, are diſcernible. The forms, the objects, and even the effects of religion, according to circumſtances and ſituations, aſſume different aſpects; but the ſentiments excited are nearly ſimilar. The ſavage who ſtarves and ſhivers in a dreary frozen region, though he believes the exiſtence of ſuperior beings, naturally regards them as cruel and unpropitious. But, in climates of which the genial warmth multiplies and matures the productions of Nature, the ideas of the characters of gods and goddeſſes become more mild and benign. Men, placed in circumſtances ſo highly favourable to happineſs, feel gratitude to the Author or Authors of the numberleſs comforts they daily enjoy. Furniſhed with food in abundance, and having perpetually before their eyes the moſt delightful ſcenery, they poſſeſs an hilarity of ſpirit, which makes them ever gay and vivacious. Gloomy ideas, and dreadful apprehenſions of futurity, are baniſhed from their thoughts. Still, however, death, the many phyſical evils of life, and fortuitous calamities produced by the elements, by earthquakes, and by occaſional inundations, alarm their minds, and excite the idea of *bad* as well as of *good* Deities. Theſe notions of *good* and of *bad* ſpirits, who ſuperintended all human affairs at certain periods of ſociety, were univerſal in all religions of the ancient ſtates of which we have any hiſtorical knowledge. Greece and Rome were formerly overwhelmed with deluges of gods and goddeſſes, both ſuperior and infernal. Hills, mountains, rivers, ſprings, the earth, the ſea, the ſun, moon, and conſtellations, were all held ſacred, or conſidered as ſo many ſeparate deities, to whom diſtinct offices were aſſigned, and particular rites and ſacrifices performed at their reſpective ſhrines. Though men, by moral doctrines far more ſublime, and more conſonant to reaſon, were long ago favoured with the genuine principles of Theiſm, or of the exiſtence of One great Creator and Governour of the univerſe; yet many of the ancient ſuperſtitions, abſurd notions and practices, ſtill ſubſiſt in ſeveral populous nations of Europe, Aſia, &c.

At a very early period of Chriſtianity, a Prieſthood, or eccleſiaſtical Hierarchy, was eſtabliſhed. The ſimplicity, the purity, and the univerſal benevolence of the Chriſtian ſyſtem, could not be ſuddenly embraced by men who had long been habituated to the pompous impreſſions and exhibitions of Paganiſm, which had been rivetted in their minds. The early teachers of Chriſtianity perceived this alarming obſtacle to the propagation of the Goſpel. To remove this obſtacle, however, and to accommodate matters, theſe teachers, with, it muſt be ſuppoſed, the moſt zealous and upright intentions, adopted a number of heathen ideas and practices, and incorporated them with the faith of what was emphatically denominated the *Catholic Church*. The leaders and paſtors of this Church perceived the advantages they might derive from this motely jumble of Chriſtianity and Paganiſm. Between theſe two inconſiſtent, and naturally oppoſite ſyſtems of religion, the minds of men were confounded and intimidated. The power of the POPE, who was regarded not only as the head of the church, but as the *Vicar* or *repreſentative* of CHRIST upon earth, ſoon increaſed to ſuch an enormous degree, that, not the people only, but every Monarch in Europe, trembled at his *anathemas*, and ventured not to take any important ſtep, even in political affairs, without the approbation of his *Holineſs!* But the ambition of the POPE, and of his numerous tribes and orders of rapacious Prieſts, had no bounds. Not Kings and Princes alone, but the pooreſt private families, were laid under monſtrous contributions, to pamper the *ſtomachs*, and miniſter to the *luſts* of theſe *holy locuſts*, the moſt deſtructive and inſatiable of all *vermin*. The arts employed to promote theſe *diabolical*, falſely called *religious* purpoſes, were various, and ſometimes ingenious. The raptures of *heaven*, and the torments of *hell*, were depicted in the higheſt colourings which imagination could invent, or terror ſuggeſt. To procure the one, and to avoid the other, *money*, *goods*, or *victuals*, were the neceſſary articles of exchange. Thoſe mental tyrants, to complete their ſyſtem of deluſion and of depredation, ſealed up every ſource of information from the people, but what they choſe to impart in artful and diſguiſed forms. Factitious miracles were preſented to the vulgar and believing eye. *Abſolutions* for actual *crimes*, and *diſpenſations* from ceremonies and rules of the church, were *ſold*. A *purgatory*, or ſtate of temporary puniſhments to *ſouls* that were either to be eternally *damned* or *ſaved*, according to the *ſums* paid for the prayers of mercenary, and generally ignorant and ſubaltern prieſts, was invented. In a word, a thouſand tricks and impoſitions were employed to augment the power and riches of the church. The *Pope* became the greateſt Emperor that ever reigned on earth; for his dominion was not only territorial but mental. This inhuman and ſordid deſpotiſm continued for many centuries, and ſo clouded the minds of men with ignorance, ſuperſtition, and timidity, that their natural powers were totally blunted. This period of *Papal* ſovereignty was afterwards, with much propriety, denominated the *dark ages;* for, whenever a ſpark of genius burſt through the univerſal gloom, it was inſtantly extinguiſhed by the authority of the church.

The ſpirits of men may, for a time, be depreſſed and debaſed by religious and political bugbears; but, from the hiſtory of human ſociety, we learn, that this humiliating and lamentable condition of mankind cannot always ſubſiſt. Some bold and enlightened minds ſtart up, aſſume their native rights, and, by their inſtruction and example, gradually looſen the chains of bigotry and oppreſſion. This happy revolution took place, though later than might have been expected, in the weſtern and northern parts of Europe. Amidſt the threatenings of *bulls*, amidſt *proſcriptions*, *murders*, and *maſſacres*, daily inroads were made upon the rapacious deſpotiſm of the Pope and his abhorrent aſſiſtants. Men of knowledge, and of generous and ardent minds, aroſe. The art of *printing*, which enabled them to diffuſe light and learning, was invented. The people ſaw with aſtoniſhment the ignorance and thraldom under which they had been enſlaved. They ſpurned at ſpiritual tyranny, and with indignation threw off its yoke. A reformation in religious opinions and in church-government was eſtabliſhed upon more rational principles. Since that glorious period, which does honour to human nature, the influence of this prepoſterous and infernal ſpecies of religion has gradually declined, and, by ſome late events, is now nearly annihilated; and, it is to be hoped, that nothing ſimilar will ever again inſult and diſgrace the characters of rational beings.

W A R.

Beside Religion, human nature is ſtamped with another univerſal character. *Hoſtilities* were coeval with the exiſtence of man, and ſtill continue to deluge the earth with blood. Avarice, reſentment, ambition, competition of intereſts, real or imaginary, are enumerated among the cauſes of *war*. But what, in the name of wonder, can be the *final* cauſe of cruelty, ſlaughter, and devaſtation? War, it has been ſaid, gives riſe to fortitude, vigilance, and other active powers of the mind. But, are there not a thouſand motives capable of exciting and calling forth theſe powers, without being attended by ſuch horrible effects? As an apology, it has been alleged, that, were it not for the intervention of war, men would increaſe to ſuch a degree that the earth could not afford them ſuſtenance. This attempt toward a ſolution of the difficulty is founded on ignorance or inatttention. There is not a country in the habitable parts of the world which, with proper induſtry and culture, is not much more than ſufficient to maintain the animals to which it gives birth. This final cauſe of war muſt, therefore, ~~be~~ relinquiſhed till ſuch an event, which is impoſſible, takes place. Nature has provided many effectual checks to a ſuperabundant population. One half of the human race periſh before they arrive at their ſeventh year. Thoſe who ſurpaſs this period of exiſtence are hourly cut off by innumerable diſeaſes and accidents. Few, very few, reach what is called *old age*, or fourſcore years.

Where, then, is the neceſſity which forces men to *exterminate* one another from the face of the earth? The *paſſions* were beſtowed upon us for the *wiſeſt* purpoſes; but we too often give to theſe paſſions a direction contrary to the original intentions of Nature. But why ſhould we be both *willing* and *able* to *pervert* the benevolent purpoſes of Nature? I will proceed no farther. The ſubject, though curious, is inextricable: I ſhall therefore diſmiſs it, by lamenting that ſtate of human nature which, even in the preſent *luminous* condition of Europe, is ſtill producing the moſt horrible, the moſt ſhocking examples of *madneſs* and *cruelty*! *.

POSTSCRIPT.

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* Conſider Europe at the moment I write—*Quem Deus vult perdere prius dementat.*

POSTSCRIPT.

COMMODORE BYRON, in his Voyage round the World *, mentions the following circumſtances concerning the Patagonians he ſaw while he was in the Straits of Magellan. When he came to an anchor in the Straits, he obſerved a number of horſemen riding backward and forward, and waving ſome white ſubſtance as an invitation to come on ſhore; upon which he ordered out a twelve-oared boat, and made toward the beach. When Captain BYRON and his attendants came within a ſmall diſtance from the ſhore, they ſaw about five hundred people, ſome on foot, but the greater part on horſeback. No weapons were perceived among them. Signs, however, were made, that they ſhould retire a little from the ſhore, and they immediately complied. He drew up his people, with proper officers at their head, upon the ſhore, and gave orders that none of them ſhould quit their ſtations till he ſhould call or beckon to them. He then approached alone toward the Indians; but, as they always retired, he made ſigns that one of them ſhould come near. One of their number accordingly came. ‘ He was,’ ſays Mr BYRON, ‘ of ‘ a gigantic ſtature, and ſeemed to realize the tales of monſters in a ‘ human ſhape. He had the ſkin of ſome wild beaſt thrown over ‘ his ſhoulders, as a Scotch Highlander wears his plaid, and was ‘ painted ſo as to make the moſt hideous appearance I ever beheld. ‘ Round one eye was a large circle of white; a circle of black ſur‘ rounded the other; and the reſt of his face was ſtreaked with paint ‘ of different colours. I did not meaſure him; but, if I may judge ‘ of his height by the proportion of his ſtature to my own, it could ‘ not be much leſs than ſeven feet. When this frightful Coloſſus

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* Hawkeſworth's edit. vol. 1. p. 27. *et ſeqq.*

‘ came up, we muttered ſomewhat to each other as a ſalutation; ‘ and I then walked with him towards his companions, to whom, ‘ as I advanced, I made ſigns that they ſhould ſit down; and they ‘ all readily complied. There were among them many women, ‘ who ſeemed to be proportionally large; and few of the men were ‘ leſs than the chief who had come forward to meet me.—They ‘ were all painted and clothed nearly in the ſame manner.—Their ‘ teeth were as white as ivory.—Except the ſkins, which they wore ‘ with the hair inwards, moſt of them were naked, a few only having upon their legs a kind of boot, with a ſhort pointed ſtick faſtened to each heel, which ſerved as a ſpur. Having looked round ‘ upon theſe enormous goblins with no ſmall aſtoniſhment, and with ‘ ſome difficulty made thoſe that were ſtill galloping up ſit down ‘ with the reſt, I took out a quantity of yellow and white beads, ‘ which I diſtributed among them, and which they received with ‘ very ſtrong expreſſions of pleaſure.’ Commodore BYRON diſtributed other trinkets among them, ſuch as ribbons, &c. ‘ Their ‘ peaceable and orderly behaviour on this occaſion,’ our author remarks, ‘ certainly did them honour, eſpecially as my preſents did ‘ not extend to the whole company. Neither impatience to ſhare ‘ the new finery, nor curioſity to gain a nearer view of me and what ‘ I was doing, brought any one of them from the ſtation that I had ‘ allotted him.’

Captain WALLIS * informs us, that he meaſured ſome of the Patagonians who appeared to be the talleſt; that one of them was ſix feet ſeven inches high; that ſome of them were ſix feet ſix, and others ſix feet five inches; but that the ſtature of moſt of them was from five feet ten to ſix feet. Their complexion, like that of the North

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* Wallis's Voyage round the World, in Hawkeſworth, vol. I. p. 374.

North American Indians, is of a dark copper colour. Their hair is ſtraight, and nearly as hard as the briſtles of hogs. They are well made, robuſt, and ſtrong; but their hands and feet are remarkably ſmall. They are clothed with the ſkins of the guanico, an animal which, in ſize, figure, and colour, reſembles a deer; but there is a bunch on its back, and it has no horns. It was remarked, that ſome of the men had a red circle painted round the left eye, and that others had their arms and different parts of their faces painted. The eye-lids of all the young women were painted black. They talked much; but, when ſpoken to in Spaniſh, Portugueſe, and Dutch, they made no reply. Of their language we were equally ignorant. They had a ſingular kind of miſſile weapon. It was compoſed of two round ſtones, covered with leather, each about a pound weight, and were faſtened to each end of a ſtring about eight feet long. This weapon they uſe as a ſling, one of the ſtones being kept in the hand, and the other is whirled round the head, till it has acquired ſufficient velocity, and is then diſcharged at the object. So dexterous are they in the management of this double-headed ſhot, that, at the diſtance of fifteen yards, they can hit a mark not larger than a ſhilling. In hunting the guanico or the oſtrich, however, they diſcharge theſe weapons in ſuch a manner, that the cord entangles the legs of the animals, who then become an eaſy prey.

‘ After I had ſpent about four hours with theſe people, I made ſigns ‘ to them that I was going on board, and that I would take ſome of ‘ them with me, if they were deſirous to go. As ſoon as I had ‘ made myſelf underſtood, above an hundred eagerly offered to viſit ‘ the ſhip; but I did not chuſe to indulge more than eight of the ‘ number. They jumped into the boats with the joy and alacrity ‘ of children going to a fair, and, having no intention of miſchief 'againſt us, had not the leaſt ſuſpicion that we intended any miſchief 'againſt them. They ſung ſeveral of their country ſongs while 'they were in the boat; and, when they came on board, did not 'expreſs either the curioſity or wonder which the multiplicity of 'objects, to them equally ſtrange and ſtupendous, that at once pre- 'ſented themſelves, might be ſuppoſed to excite. I took them 'down into the cabin, where they looked about them with an un- 'accountable indifference, till one of them happened to caſt his eyes 'upon a looking-glaſs, which afforded them infinite diverſion. They 'advanced, retreated, and played a thouſand tricks before it, laugh- 'ing violently, and talking with great emphaſis to each other.— 'They eat indiſcriminately whatever was offered to them; but they 'would drink nothing but water. From the cabin I carried them 'all over the ſhip; but they looked at nothing with much attention, 'except the animals which we had on board for live ſtock. They 'examined the hogs and ſheep with ſome curioſity, and were ex- 'ceedingly delighted with the Guinea hens and turkeys. They did 'not ſeem to deſire any thing they ſaw, except our apparel; and 'one of them, an old man, aſked for that. We gratified him with 'a pair of ſhoes and buckles; and to each of the others I gave ſome 'trinkets.—I ſhowed them the great guns; but they did not appear 'to have any notion of their uſe. After I had carried them through 'the ſhip, I ordered the marines to be drawn up, and go through 'part of their exerciſe. When the firſt volley was fired, they were 'ſtruck with aſtoniſhment and terror. The old man, in particular, 'threw himſelf down upon the deck, pointed to the muſkets, and 'then, ſtriking his breaſt with his hand, lay ſome time motionleſs, 'with his eyes ſhut. By this we ſuppoſed he intended to ſhow us, 'that he was not unacquainted with fire-arms, and their fatal effect. 'The reſt, ſeeing our people merry, and finding themſelves unhurt,

'ſoon reſumed their cheerfulneſs and good humour, and heard the
'ſecond and third volley fired without much emotion; but the old
'man continued proſtrate upon the deck for ſome time, and never
'recovered his ſpirits till the firing was over. When the boat put
'off with them, they all began to ſing, and continued their merri-
'ment till they got on ſhore *.'

Nootka Bay—Prince William's Sound.

THE inhabitants are generally of a ſhort ſtature, and ſquare-made. The faces, both of men and women, are flat and round, with high cheek-bones, and flattiſh noſes. Their teeth are white; their eyes dark, and quick-ſighted. Their complexions are whiter than thoſe of the ſouthern Indians; and ſome of the women have roſy-coloured cheeks. Their hair is black, ſtraight, and long; and, on the death of a friend, as a mark of mourning, they cut it ſhort. The legs of the men are, in general, ill ſhaped, which Captain PORTLOCK attributes to their ſitting perpetually in the ſame poſition in their canoes. They are as fond of what they eſteem perſonal ornaments; for they paint their faces and hands, bore their ears and noſes, and ſlit their under-lips. In the holes made in their noſes, they hang ornaments of bone or of ivory, which are often two or three inches long. At the ears they generally wear beads, which hang down to the ſhoulders; and, in the ſlit in the lip, they place a bone or ivory inſtrument with holes in it, from which they ſuſpend beads that reach as low as the chin. Theſe holes in the lip disfigure them greatly; for ſome of them are as large as their mouths. With all this fancied finery, however, in their perſons they are extremely filthy, and overrun

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* Captain Wallis's Voyage round the World, Hawkeſworth, vol. 1. p. 375. &c.

run with vermin. Their clothing conſiſts entirely of the ſkins of quadrupeds and of birds. In general, they are a friendly people, and remarkably affectionate to their wives and children. But your attention to their women muſt be carried no farther than giving them preſents; for nothing irritates them ſo much as taking improper liberties with their females. Like all other Indians, they have a ſtrong propenſity to ſtealing, not only from ſtrangers, but from one another. 'In the courſe of my trading with them,' ſays PORTLOCK, 'I have frequently ſeen them ſteal from one another; 'and, on being detected, they will give up the articles they have 'ſtolen with a laugh, and immediately appear as unconcerned as if 'nothing had happened amiſs. I am ſure, that with them thieving 'is rather thought a grace than a diſgrace; and the complete thief 'is a clever fellow, but the burgling pilferer is leſs admired.— 'During our intercourſe with them, they grew leſs addicted to 'thieving, in conſequence of my ſometimes appearing a little angry 'with them, and taking ſome pains to convince them of the impropriety of their behaviour. Upon the whole, they appear a good 'kind of people; and I am convinced, in a little time, provided a 'ſettlement of ſufficient ſtrength were eſtabliſhed, would be an induſtrious ſet of people, in hunting and procuring the ſea-otter and 'other ſkins for ſale to the ſettlers *.'

Both men and women eſteem long hair as an ornament. When a relation dies, they cut their hair pretty ſhort, a general mark of mourning among all theſe Indian tribes. Polygamy ſeems not to be practiſed here; 'as I never obſerved,' PORTLOCK remarks, 'any 'one of them to have more than one woman, whom he ſeemed to 'conſider as his wife, to whom they pay very ſtrict attention, and 'treat

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* Portlock's Voyage round the World, from the year 1785 to 1788, p. 249. &c.

‘ treat with a great deal of tenderneſs. You cannot affront them ‘ more than by attempting to make advances to their wives. They ‘ are likewiſe very fond of, and remarkably affectionate to, their ‘ children. It is not the cuſtom with thoſe people, as with the ‘ South Sea Iſlanders, for the men and women to eat ſeparately; nor ‘ are the women confined to eat meats of a particular deſcription; ‘ but for men, women, and children, to ſit down indiſcriminately at ‘ their meals, which chiefly conſiſt of fiſh of different kinds.— ‘ Their perſons are, in general, much about the ſize of Europeans. ‘ The men have a very fierce and ſavage aſpect, which, with their ‘ dreſs, gives them much the appearance of warriors. Their weapons of war are daggers and long pointed ſpears. They are very ‘ eaſily irritated, and would make very little ſcruple to kill you ‘ when they think themſelves injured. More than once I had nearly experienced that fate, from ſome trifling diſagreements in trade. ‘ But, being pretty well acquainted with their tempers, I guarded as ‘ much againſt them as poſſible; and, on all occaſions, took care to ‘ be well provided for them, in caſe of an attempt, by keeping my ‘ piſtols ready-charged before me *.’

Captain PORTLOCK likewiſe informs us, that their women, if kept clean, inſtead of being perpetually covered with filth and naſtineſs, would be very agreeable. In general, their features are pleaſant, and their behaviour modeſt.

‘ The ineſtimable value of the American furs,’ Captain PORTLOCK remarks, ‘ will ever make it a deſirable trade, and, whenever ‘ it is eſtabliſhed upon a proper foundation, and a ſettlement made, ‘ will become a very valuable and lucrative branch of commerce. ‘ It

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* Portlock’s Voyage, p. 290. &c.

‘ It would be an eaſy matter for either Government or our Eaſt ‘ India Company to make a ſettlement of this kind; and the thinneſs of the inhabitants will make it a matter of eaſy practicability; ‘ and, as the Company are under the neceſſity of paying the Chineſe ‘ in caſh for their teas, I look upon it a ſettlement on this coaſt ‘ might be effected at a very inconſiderable expence, which would ‘ more than pay them for every article that is brought from China.’

CHAPTER V.

Of Sleep and Dreaming.

SECT. I.

Of the Nature and efficient Cauſes of Sleep and Dreaming—Dreams characteriſtic of the Dreamer—Inſtead of a Diary, a Nocturnal would more effectually unfold the real Diſpoſitions of Men—Specimen of a Nocturnal—Utility of Dreaming—Dreams not peculiar to Man.

AMONGST the various powers and operations of the human mind, none make a more capital figure than that of the *imagination.* To this faculty we are principally indebted for that great variety of pleaſure and amuſement which make life agreeable, and reconcile us to the many pains and difficulties incident to our ſpecies. By imagination, as far as relates to the preſent ſubject, is meant, that operation of the mind which recals paſt ideas, or ſeparates and combines ideas in a manner ſo lively, that the objects they repreſent ſeem to have a real exiſtence, and affect us accordingly.

This definition of imagination, though by no means complete, is ſufficient for my preſent purpoſe. Every man *dreams* more or leſs. As far as I can learn, this ſubject has never been treated of in a rational or philoſophical manner *.

Sleep is the principal, though not the only ſource of dreams. I ſhall, therefore, make a few obſervations on that ſtate of our exiſtence which is ſo fertile in producing the phenomenon under conſideration.

Man, while awake, is a very paſſive animal. Independently of his own inclination, his eyes and ears are conſtantly receiving impreſſions from a multiplicity of external objects. He is likewiſe ſtimulated by his other ſenſes and bodily powers. His ſtomach muſt be alternately filled and emptied. The ſpring of his nerves and muſcles neceſſarily impels him to motion. The pain of inactivity itſelf is ſufficient to ſpur him on to action. But, no organ of the body, no faculty of the mind, can admit of long-continued action, without laſſitude or a diſpoſition to reſt.

During ſleep, our organs are no longer ſubject to receive impreſſions paſſively from external objects; the elaſticity of the nerves and muſcles is greatly relaxed; but the imagination, inſtead of being blunted, is whetted, and rendered more active. To give free ſcope to the imagination, it ſeems neceſſary that all communication with external objects ſhould be entirely cut off. Having curſorily mentioned the principal circumſtances and ſituations favourable to ſleep and dreaming, we ſhall next inquire whether any analogous circumſtances and ſituations exiſt when our ſenſes and other powers are awake.

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* The ſubſtance of this chapter was read before the *Newtonian Society* of Edinburgh in the year 1764.

The great variety of characters, tempers, and peculiar biaſſes exhibited in human nature, renders it difficult to ſelect any general turn of mind as a proper example for illuſtrating this ſubject. Theſe differences, however, are not confined to men when awake. Dreams, on the contrary, are as characteriſtic of the genius or diſpoſitions of any individual as his waking thoughts. A man whoſe ordinary train of thinking is quick and lively, will never find the quickneſs or vivacity of his perceptions retarded or blunted by ſleep. For elucidating this point, I ſhall make choice of a perſon who is naturally inclined to indulge reveries. Let us ſee how a perſon of this deſcription is affected by the common occurrences of life. We ſhall firſt ſuppoſe him walking along the ſtreets of a populous city. Numbers of objects preſent themſelves on every hand, and ſolicit his attention. Among others, the rapid motion and noiſe of a coach oblige him to fly ſuddenly to a ſide, in order to eſcape from danger. His fortunate eſcape at firſt gives him pleaſure. But, upon reflection, he cannot refrain from repreſenting to himſelf, by means of the imagination, how miſerably he ſhould have been bruiſed, had he been leſs ſwift in his movements. This thought continues to torment him, till it is baniſhed by ſome other idea which claims a ſuperior attention. Let us next view him in a ſolitary walk. Here, if his mind be perfectly calm, he indulges his fancy with ſome fictitious ſcene, in which, by a natural propenſity, himſelf is always the hero. Whether this ſcene be of a gay or diſtreſsful kind; whether the ſituation of his imaginary affairs demands courage, compaſſion, generoſity, or gratitude, he not only feels the ſentiments which theſe virtues inſpire, but his actions uniformly correſpond with his ſentiments.

ments. Viſionary ſcenes of this kind are not always of a tranſitory nature. When the ſituation of the place, and the preſent diſpoſition of the mind, are favourable, a perſon often indulges that diſpoſition till he performs a complete drama.

We ſhall now ſuppoſe our man of ſenſibility to be placed on the top of a precipice, or on the brink of a deep pit. In theſe ſituations, his mind is ſwifter than his eyes; for he is generally down himſelf before he gets a ſight of the bottom. Some people are ſo much under the influence of imagination, that they have been obſerved to approach the mouth of a pit with cautious ſteps, and, as ſoon as they have looked down a few yards, fly back with horror, till they get far beyond the poſſibility of danger. Nay, ſo powerful is the imagination, and ſo prone to verify its ideas, that, were it counterbalanced by no other principle, a man would throw himſelf headlong from a precipice, merely to gratify his preſent feelings. Farther, when a perſon ſhuts his eyes, or rather when he is in an apartment without light; if, at the ſame time, he be alone, and his mind not ruffled or occupied by any painful ideas, then Fancy lays faſt hold of him, and turns his attention to ſuch objects as ſhe pleaſes to repreſent.

Not to multiply particular ſituations which are favourable to the operations of imagination, I ſhall only add another inſtance on account of its ſingularity.

Fevers, and ſeveral other diſtempers, by ſome unaccountable influence of the body upon the mind, almoſt totally deprive us of our reaſoning powers, and pervert our ſenſes to ſuch a degree, that we either miſtake common objects, or they make little or no impreſſion upon us. But, though theſe diſtempers deprive us of judicious reflection,

flection, and of regular impreſſions from the ſenſes; yet the train of our perceptions, which is the food of the imagination, inſtead of being interrupted, proceeds with the greater rapidity. I ſhall not attempt to aſſign reaſons why particular affections of the body impair or deſtroy the act of reaſoning or reflecting: I ſhall only remark, that the ordinary train of our perceptions is, in ſome meaſure, a mere involuntary progreſſion of ideas. But reaſoning is a very complex operation, and cannot be performed without the united efforts of almoſt the whole powers of the mind. Conſidering, then, the intimate connection between our mental and corporeal faculties, is it not extremely natural, that indiſpoſitions or derangements of the body ſhould more readily deprive us of a power whoſe operations are complex and difficult, than of that faculty the exertions of which are not only involuntary, but often act in direct oppoſition both to reaſon and inclination.

From the above analyſis, the following remarks are naturally ſuggeſted: *1ſt*, That the imagination, when not reſtrained by judgment, or checked by impreſſions from external objects, uniformly endeavours to complete any ſcene or ſet of ideas which happens to ariſe either from the ordinary train of perceptions, or from any ſtriking impreſſion received by the ſenſes; and, *2d*, That circumſtances or ſituations which tend to weaken our reaſoning or reflective powers, or to prevent the impreſſions of external objects, give additional force and activity to the imagination.

Theſe obſervations ſhall now be applied to *dreaming*. When a perſon is juſt about to fall aſleep, he feels a ſtruggle between reaſon and imagination. The former grows gradually weaker and weaker, while the vigour and activity of the latter continually increaſe till it completely gains the aſcendant. Every man muſt have repeatedly felt this ſtruggle: But we are particularly conſcious of it when reaſon gets the better of imagination. All the time when a perſon is *between* ſleeping and waking, as it is termed, he is generally in eager purſuit after ſome airy phantom; but, if reaſon chances to prevail, he makes a ſudden ſtart, reſumes the power over his half dormant faculties, and wonders at his credulity in believing the actual exiſtence of ſuch fleeting fancies. Sleep, however, at laſt gains a complete victory; or, in other words, our reaſoning powers yield entirely to thoſe of the imagination. It was hinted above, that certain circumſtances are peculiarly ſuited to the exerciſe of the imagination; ſuch as, alarming or dangerous ſituations, ſolitude, tranquillity of mind, quieſcence of judgment, emancipation from the impreſſions of external objects, darkneſs, &c. Now, is it poſſible to conceive a more complete coincidence of all theſe circumſtances than takes place during ſleep? Shut up from every external impreſſion, involved in the blackeſt darkneſs, in a word, the imagination, freed from every check, roams at large, and triumphs without controul. Every idea that occurs, makes ſuch a lively impreſſion, that it produces a thorough conviction of the exiſtence and actual preſence of the object. This belief in the real exiſtence of imaginary objects conſtitutes the ſole difference between the ideas of imagination when aſleep, and the ſame ſpecies of ideas which occaſionally ſolicit attention in our waking hours. It only, of courſe, remains to inquire into the cauſes which produce this conviction or belief. We have already taken notice of ſome affections of the body which, in a great meaſure, have the power of realizing our imaginary ideas. Fevers, madneſs, and ſome other diſtempers, uniformly ſuſpend the power of reaſoning, which, as daily experience too frequently ſhows, makes the unhappy perſon loſe the faculty of diſtinguiſhing between the ideas of imagination and the impreſſions received from real objects. Without going deeper, therefore, it is perhaps ſufficient to ſay, that ſleep is one of thoſe particular diſpoſitions of body which invariably produces this ſtrange effect.

The theory of *dreaming* is now, I imagine, pretty obvious. The following obſervations, however, will render it ſtill more intelligible. In the ſeveral ſituations in which I have ſuppoſed our man of ſenſibility to be placed, and, in general, whenever the imagination fixes upon any particular ſcene or event, were it not for the intervention of reflection, or the impreſſions of external objects, we ſhould uniformly purſue theſe ideas through all their relations as well when we are awake as when aſleep: Nay more; we ſhould be as thoroughly convinced of the real exiſtence of the objects, and as ſenſibly affected with the various incidents, as if we were in the moſt profound ſleep. For example: A man looks down with horror from the top of a high tower. Even the idea of abſolute ſafety is not ſufficient to make him eaſy: But, in order to obtain relief, he finds himſelf impelled to deſcend as quickly as poſſible. Now, in ſuch circumſtances, we are indebted to reaſon for the idea of ſecurity; and the loco-motive faculty enables us to deſcend. But, when the ſame or ſimilar ſituations occur to the imagination during ſleep, the acuteneſs of a perſon's feelings is greatly augmented. This increaſe of feeling, however, is not the only difference. The abſence or imbecillity of his reaſon excludes the idea of ſecurity; and the preſent inactive condition of his body creates a dreadful conſciouſneſs of utter inability to move in any other direction than that of tumbling headlong down.

SECT. II.

Of the final Cauſes of Dreaming.

THAT muſic, ſprightly converſation, and, in general, every exerciſe that falls under the denomination of *amuſement*, recreates the mind more effectually than mere inactivity, is a fact which admits of no controverſy. Sleep, in one ſenſe, is nothing more than a total ſuſpenſion from action. But this inactivity is not, of itſelf, ſufficient for repairing that laſſitude of organs and waſte of ſpirits, which are the never failing offſpring of vigilance and exerciſe. The all-wiſe Author of our exiſtence foreſaw this defect, and hath accordingly provided the proper remedy. When aſleep, the body, it is true, is inactive; but the imagination is vigorous: And, I may, from experience, venture to affirm, that the imagination uniformly conducts us to ſcenes that are of a gay, ſerene, and amuſing nature, unleſs the mind is ſoured by cauſes which excite diſagreeable ideas, unleſs the body is ſtruggling with diſeaſe or the ſeeds of diſeaſe, unleſs our characters and diſpoſitions are tinctured with malice, or haunted with remorſe. The gay and entertaining ſcenes preſented by the imagination during ſleep are much better adapted for recreating and invigorating our faculties than mere inſenſibility.

But this final cauſe of dreaming, however obvious, may appear liable to an objection. If this reaſoning be juſt, how does it happen, it may be ſaid, that diſagreeable dreams are ſo frequent? This objection, however, inſtead of injuring the former, ſuggeſts another excellent final cauſe.

So delicate is the conſtitution of man, that, beſide the many dangerous diſtempers to which he is conſtantly expoſed, there is a great variety of little uneaſineſſes, which, though not ſo alarming as to call forth the ſympathy of friends, are nevertheleſs capable of impairing the happineſs, and fretting the lives of individuals. There are ſome diſorders which almoſt elude our feelings, but, if not timely remedied, would probably cut off our exiſtence in a few moments. It is during ſleep that we are moſt liable to theſe ſecret diſorders. But, as ſhall immediately be ſhown, the effects theſe diſorders might produce are amply provided againſt by Nature. The chief cauſes of diſagreeable dreams may be reduced to two: 1. When a perſon is actually labouring under a diſtemper, or happens to lie in a poſture which diſturbs ſome of the animal functions. 2. When any painful idea occurs in the ordinary train of perceptions. The firſt cauſe ariſes from morbid derangements in the corporeal organs, which, by a benevolent and ſalutary inſtitution of Nature, communicate painful and horrid ideas to the mind. The only difference between theſe alarming ideas, and thoſe which we feel in ſimilar circumſtances while awake, is this: In the former, although our ideas excite the ſame ſpecies of feelings; yet theſe feelings are generally referred to ſome wrong cauſe. This common miſapprehenſion of the particular part really effected is, however, productive of no bad conſequences: A furious engagement with the devil, an interview with the ghoſt of a departed friend; or, in general, ſome horrible ſcene generally comes to our aid, and gives ſuch a briſk ſhock to the conſtitution as ſeldom fails, in caſes, at leaſt, where a longer continuance in ſleep would be hurtful, to rouſe us into reaſon and ſafety. Being thus ſuddenly awaked, the cauſe of our diſagreeable dream, whether it derives its origin from a hurtful poſition of the body, or any irregularity in the motions of the fluids, is now not only clearly perceived, but inſtantaneouſly removed. Perſons, therefore, who are ſo unfortunate as frequently to ſtand in need of diſagreeable dreams, inſtead of complaining of the pain and horror they occaſion, ought to regard them as kindly meſſengers ſent to relieve them from a diſeaſe, of which they would be totally ignorant, but which, without their friendly interpoſition, would probably have put a final period to his exiſtence.

The ſecond cauſe of diſagreeable dreams is derived from the particular temper or diſpoſition of the dreamer's mind previous to ſleep, or to painful ideas accidentally occurring in the ordinary train of perceptions. Here it is worthy of remark, that, during ſleep, our ideas of pleaſure and pain are greatly augmented. Pain, in particular, commonly riſes to ſuch an excruciating degree, that it rouſes us from ſleep entirely. Every man, at ſome time or other, has had an imaginary fall from a great height. But I doubt much if any perſon ever arrived at the bottom. He feels himſelf moving in the air; he even reflects on the terrible effects which muſt reſult from this fall. But, before that horrid cataſtrophe happens, he never fails to awake. It is impoſſible to determine what the conſequences would be, were the imagination allowed to complete ideas of this deſtructive nature. The effects they produce, even without being completed, are very violent. Alarmed with terror, the motions of the fluids are increaſed to a hurtful degree; cold ſweats are produced; the ears tingle; and great confuſion is perceived in the brain. Now, if the imagination were allowed to complete ſuch ideas, theſe noxious effects would at leaſt be greatly augmented; their number too would be increaſed; and it is difficult to determine, whether a perſon who falls from a precipice in imagination would not undergo the ſame fate as he who does ſo in reality. Men who have the misfortune to be ſubject to diſagreeable dreams, learn by experience to know that they are *dreaming*. When terrified with impending danger, and even death, I have often ſaid to myſelf, ‘Don’t be ſo much alarm-‘ed: You have been in the ſame or in ſimilar ſituations, which ‘were uniformly diſcovered to be *dreams*.’ This ſpecies of dormitory reaſoning greatly alleviates the pain, and not unfrequently gives an oppoſite direction to the imagination.

Another final cauſe muſt not be omitted. It would be improper, however, to confine this cauſe ſolely to ſuch dreams as are occaſioned by ſleep; becauſe it is fully as conſpicuous, and perhaps more uſeful, in thoſe exertions of imagination, which are incidentally indulged when our ſenſes are in a ſtate of vigilance and activity. It has been remarked above, that the imagination, in ſituations favourable to its operations, uniformly leads us into ſcenes of action which give riſe to the exerciſe of the reſpectable and benevolent virtues. We have all, at one time or another, ſuppoſed ourſelves poſſeſſed of a great fortune. When indulging this ſpeculation, we never fail to imagine, that we would behave with the utmoſt condeſcenſion to our inferiors; that we would cheriſh and reward the virtuous, patroniſe the learned, ſupport the indigent; and, in a word, that we would exerciſe the moſt unbounded generoſity and beneficence. Upon a curſory view of this ſubject, ſome people are apt to think, that a propenſity to indulge reveries of this nature has its foundation in vanity, and are inclined, from that conſideration, to curb and reſtrain it as vain and preſumptuous, or, at beſt, as a frivolous mode of employing our thoughts. It merits attention, however, that nature never gives an original propenſity to the mind, but with a view to produce ſome beneficial purpoſe. But it will appear, from the following conſiderations, that the propenſity to indulge fancied ſituations, and the particular conduct prompted by theſe ſituations, is wiſely calculated to ſtrengthen and promote the virtue of individuals.

Although we ſhould never actually be poſſeſſed of the ſuppoſed great fortune; although theſe imaginary ſcenes ſhould never happen; yet, ſo various are the incidents and ſituations which may fall out in the courſe of any man's life, that ſituations and incidents, if not preciſely the ſame with thoſe he may have figured in his imagination, at leaſt reſembling them in their principal circumſtances, will undoubtedly occur. Now, when any circumſtances in life demands the exertions of benevolence, compaſſion, courage, fortitude, or reſignation, will not we be better prepared to act with dignity and propriety, than if theſe circumſtances had occurred before we had any previous intimation from our feelings how our conduct ought to be directed on ſuch intereſting occaſions? Hence the indulgence of aereal, though poſſible ſcenes of action, has an evident tendency to ſtrengthen our virtue, to enlarge our experience, to improve the vivacity of our pleaſurable feelings. Of courſe, inſtead of checking, it is our duty to encourage the reveries of fancy, provided her calls are not ſo frequent as to interrupt purſuits of a more important nature.

SECT. III.

Every Perſon may derive Advantage from Dreams.

TO know one's ſelf is the moſt important of all knowledge, and, at the ſame time, the moſt difficult to attain. Mankind are ſo artful in diſguiſing the real motives of their actions, ſo ingenious in deceiving themſelves, ſo averſe to the diſcovery of vice or imperfection in their ſentiments or behaviour, ſo keenly engaged in the occupations of life, and ſo prone to contraſt themſelves with the moſt profligate of the ſpecies, that they generally reſt ſatisfied with their condition, and ſeldom inquire with any degree of impartiality into the real character or temperature of their minds. A more ſimple method of acquiring a knowledge of ourſelves muſt be acceptable to every perſon who thinks himſelf intereſted in the inquiry. This end, I preſume, may be accompliſhed by a moderate attention to our dreams. *Dreaming* muſt here be underſtood in the moſt common acceptation of the word; for an inquiry into the natural tendency of imagination while awake, would engage us in a ſtruggle with all the obſtructions to ſelf-knowledge formerly ſuggeſted. Let us, then, attend to thoſe particular vices which we are moſt inclined to indulge in ſleep. That vice which is moſt frequently and moſt luxuriouſly indulged in our dreams, may ſafely be eſteemed our predominant paſſion. Though motives of intereſt, decency, and the opinions of our friends, may have reſtrained us from actual gratification, and created a deluſive belief that we are no longer ſubject to its ſollicitations; yet, if the imaginary gratification conſtitutes an agreeable dream; if it is then indulged without check or remorſe, we may freely conclude, that we ſtill remain its humble votaries, and that thoſe motives which deter from actual indulgence are not the genuine motives which virtue inſpires.

This method of diſcovering our real characters, it may be ſaid, is more uncertain, and attended with greater difficulty than deliberate ſelf-examination. But, we ſhould reflect, that, during ſleep, the mind is more ingenuous, leſs inclined to palliate its real motives, leſs influenced by public opinion, and, in general, more open and candid, than when the ſenſes are awake. It is true, that, by the return of external objects, buſineſs, and intercourſe with the world, dreams are apt to eſcape from the memory, and that this circumſtance, in ſome meaſure, deprives us of the advantages which might otherwiſe reſult from them. This is, indeed, the only difficulty we have to encounter; but it is not unſurmountable. It may be removed by a few minutes labour every morning. Let any perſon who wiſhes to know his real character, as ſoon as he gets up, revolve, as accurately as he can, thoſe thoughts which made the deepeſt impreſſion upon him while he was aſleep, what ſcenes gave him pleaſure or pain, what actions he approved or diſapproved, and let him inſtantly write them in a book kept for the purpoſe. In oppoſition to a *Diary*, this book may be entitled *A Nocturnal.* The nocturnaliſt, however, muſt be careful to give a candid account of his ſleeping tranſactions, marking with accuracy the various feelings which the particular incidents excited. At firſt, perhaps, his buſineſs will be ſoon executed. But the mere habit of writing, ſo ductile is the human mind, will ſoon make him both more attentive to his dreams, and increaſe his faculty of remembering them.

For the ſake of illuſtration, and to ſhow that this ſcheme is not impracticable, I ſhall ſubjoin, as a ſpecimen, the capital ſcenes of a few nights dreams which I recorded thirty years ago.

Specimen of a NOCTURNAL.

THE firſt night I found myſelf in a moſt tremendous ſituation. Alarmed by a ſudden ſhock attended with a hollow ſubterraneous noiſe, I ran out to the ſtreets of this populous city, in order to diſcover the cauſe. A dreadful proſpect preſented itſelf to view. The ground began to undulate like the waves of the ſea; ſheets of fire dazzled the eye; pales of thunder ſtunned the ears; the buildings ſplit in a thouſand directions; and, had not the native horrors of the ſcene ſoon reſtored me to reaſon, I ſhould infallibly have been cruſhed to atoms.

The ſecond night's entertainment, though not ſo alarming, was much more extravagant and ludicrous. I was for ſome time diverted with a furious diſpute between Dr MONRO and Dr WHYTT concerning the uſes of the *Deltoid Muſcle!* The combatants at length became ſo hot, that they were juſt proceeding to give the diſpute an effectual termination by the intervention of the cudgel, when I awoke; and behold it was a dream!

The third night, I found myſelf in the midſt of a brilliant company of ladies and gentlemen. Chearfulneſs and innocence ſeemed to beam from every countenance. I was treated with the utmoſt affability and complaiſance. My heart began to exult with the moſt pleaſant emotions. The muſic ſtruck up; each took his fair partner by the hand, and a ſprightly dance immediately commenced. My ſpirits were much more elevated than I ever had experienced on any former occaſion. I moved through the various evolutions of the dance with as much eaſe and alacrity as if my body had been a mere vehicle of air. But, in the midſt of this enchanting ſcene, while ſetting to a young lady, my *breeches* fell plump to my heels! I quickly attempted to lay hold of them; but in vain. The very power of reaching forth my hand was abſtracted from me. I remained fixed as a ſtatue, and the dance was interrupted. The bluſhes of the company diſcovered how ſenſibly they felt my misfortune; but none had the courage to aſſiſt me. In ſhort, the feelings peculiar to ſuch a whimſical ſituation became at laſt ſo exquiſitely painful, that I ſhould infallibly have fainted away, had not ſleep inſtantly departed, and reſtored me to reaſon and joy.

The fourth night's employment was ſtill more ſerious and awful. I ſaw a groupe of winged angels deſcending from the ſky. One of them, who ſeemed to lead and command the reſt, had a large golden trumpet in his hand. When near the ſurface of the earth, he ſounded the inſtrument, the noiſe of which made all Nature ſhrink. He announced the arrival of the laſt day, that day when the quick and the dead are to be judged, and receive everlaſting rewards or torments, according to the merit or demerit of the deeds done by individual mortals. Aſtoniſhment and anxiety arreſted all the living. They ſtood motionleſs, and looked aghaſt. A new ſcene inſtantly appeared. I ſaw the dead riſing in myriads all around me. I particularly remarked, that, in the *Grey-friars* church-yard, *hundreds* of both ſexes puſhed one another out of the *ſame graves!* The day was ſo cold and froſty, that the terrified expectants of doom were all ſhivering. Another phaenomenon ſolicited my attention. I ſaw immenſe numbers of *leaden pipes* filled with *cold water.* Another trumpet was ſounded, and the angel proclaimed, that, inſtead of being roaſted in the *flames* of hell, the *damned* were to have their *limbs* eternally immerſed in theſe *water pipes.* Terrified, and half-petrified with this frigifying idea, I got the ſtart, and awoke. Upon examination, I found, that, by ſome accident, my limbs had been uncovered, and were exceſſively cold. This ſimple incident produced the whole ſcenery I have repreſented.

But here I muſt ſtop, leſt I ſhould diſcover more of my own character than would be conſiſtent with prudence.

SECT. IV.

Of Ominous Dreams.

THE frequent accounts of ominous dreams we meet with in hiſtory, joined to the many ſtories which are daily related, ſufficiently juſtify a few remarks upon the queſtion, Whether ſupernatural ſuggeſtions are to be expected in dreams?

To deny the poſſibility of ſupernatural ſuggeſtions either when aſleep or awake, would be both preſumptuous and abſurd. On the contrary, I can conceive a ſuperior being ſo thoroughly acquainted with the human frame, ſo perfectly ſkilled in the connection and mutual dependence which ſubſiſt between our intellect and our ſenſitive organs, as to be able, by titillating, in various modes and directions, particular combinations of nerves, or particular branches of any ſingle nerve, to excite in the mind what ideas he may think proper. I can likewiſe conceive the poſſibility of ſuggeſting any particular idea or ſpecies of ideas, by affecting the nerves in the ſame manner as theſe ideas affect them when excited by any other cauſe.

The notion of dreams, however, being frequently ſuggeſted by ſuperior beings, is founded partly in ignorance, and partly on a fond regard which men are apt to indulge for every thing that relates to themſelves. If it accidentally occurs to a man's mind, which is by no means an uncommon caſe, that a friend is ſick, dead, or in circumſtances of great diſtreſs; to ſatisfy himſelf, he inquires into the ſituation of this perſon. Inſtead of finding him in the miſerable circumſtances he had fancied, he perhaps ſees him not only in health, but making merry with his companions. This deluſive and accidental impreſſion is diſcovered to be falſe in every circumſtance; and, of courſe, it is for ever concealed. But, ſuppoſing his friend to have actually been in the ſituation which he had imagined; then the caſe is entirely reverſed. He is no longer aſhamed of his fond conception. On the contrary, he doubts not that it proceeded from a ſupernatural cauſe; and hence, to gratify his vanity, he tells it on all occaſions, in order to inſinuate his uncommon connection with heavenly powers.

Allowing that events and ſituations which mankind repreſent to themſelves, by means of the imagination, do ſometimes actually happen; yet this circumſtance is not wonderful. Conſidering the activity and wanderings of the imagination, it is ſurpriſing that ſo few examples of this kind occur. We never hear of the numberleſs inſtances where there is no coincidence between the events and the previous imagination. But, whenever they chance, even in ſlight relations, to coincide, which is extremely ſeldom, they are noiſed abroad with eager induſtry.

Theſe obſervations apply to dreaming with accumulated force. In ſleep, the imagination is much more active, and the time ſpent in fanciful repreſentations is vaſtly greater than when we are awake. A greater variety of incidents, of courſe, occur in dreaming. Is it not, then, extremely ſtrange, conſidering the natural diſpoſition of the mind to gueſs at future events, that a man ſhould continue to dream, both day and night, for fifty or ſixty years together, without, perhaps, being able to recollect a ſingle inſtance of his foreſeeing any particular event?

Upon the whole, were the examples of ominous dreams more frequent, and better authenticated than they generally are, they might with great propriety be aſcribed to cauſes merely fortuitous, and totally independent of any ſupernatural impulſe or ſuggeſtion.

SECT. V.

Of the Second Sight, or a Prophetic Power.

THE obſervations made in the two foregoing ſections may, with much propriety, be applied to what is called the *Second Sight.* The perſons ſaid to be poſſeſſed of this faculty of ſeeing actual repreſentations, or pictures of future events, are, in Scotland, chiefly confined to the Highlands and weſtern iſlands. Like many other prophets, both ancient and modern, our profeſſors of *Second Sight* are illiterate, vulgar, and viſionary beings. Their pretenſions, however, are not mercenary. They neither aſk nor receive money for their ſuppoſed predictions. In this, as well as in all other countries, while the people remain in a ſtate little removed from abſolute barbariſm, ſuperſtition ſpontaneouſly ariſes from a thouſand cauſes; poverty, idleneſs, high and rugged mountains, bleak heaths, a ſterile ſoil, naturally excite gloomy and frightful ideas in uninformed minds. Our Highland *ſeers* are exactly in this melancholy ſituation. Their predictions, or rather reveries, accordingly, are all expreſſive of deaths, and other human calamities.

About thirty years ago, a moſt abſurd publication appeared at Edinburgh under the title of *A Treatiſe on Second Sight*, in which more than a hundred inſtances are related, almoſt the whole of them portending diſaſtrous events. Were it not with a view to baniſh, as far as I can, a notion ſo diſgraceful to our country, and ſo humiliating to human nature, I ſhould not have deigned to ſully my book with the following ſpecimen: 'DONALD MACKINNON, an honeſt tenant in *Haliſtra* in *Waterniſh*, relates, that, in harveſt 1760, in 'the duſk of the evening, as he was binding and putting together 'corn, on a ſudden he ſaw a neighbour of his foremoſt, and followed by a pretty throng gathering of people, carrying a corpſe 'directly through a ſtanding corn-field of his own, which he was 'not well-pleaſed at; however, through *fear* that it might be a *viſion*, 'he did not chuſe to challenge his neighbour. He told what he had 'ſeen to his wife and family when he came home, ſaying, If it was 'a *viſion*, it would undoubtedly be verified ere long; and, to ſatisfy 'his mind concerning what he had ſeen, went early next morning 'to view the ſtanding corn, to ſee if any of it was trode down, but 'not one ſtalk. About the ſame time next year, he ſaw his neighbour, the company and corpſe, in reality, coming through the ſame 'field from *Griſhirniſh*, to bury it at the church-yard of *Trumpan* *.'

This ſimple example comprehends the ſpirit and tendency of the whole book; for every ſtory it contains is equally ridiculous.

But here we muſt pauſe: The learned and ingenious Dr SAMUEL JOHNSON, who, ſome years ago, honoured Scotland, and even its Hebrides, with a viſit, from ſimilar ſtories, was credulous enough to believe in the *ſecond ſight*. The Doctor's definition of this ideal faculty is curious. 'The *ſecond ſight*,' ſays he, 'is an impreſſion 'made either by the *mind* upon the *eye*, or by the *eye* upon the *mind*,

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* Treatiſe on Second Sight, p. 159.

'by which things *diſtant* or *future* are perceived, and *ſeen* as if they 'were *preſent* *.' To comprehend this definition would require a man to be poſſeſſed of both the *firſt* and *ſecond ſights !*

To do juſtice to the Doctor, however, though he execrates, with a ſuperſtitious meanneſs, that form of church-government called *Preſbyterianiſm*, and prefers to it even *Papal deſpotiſm ;* yet, upon this ſubject, he involuntarily and awkwardly makes a very great and a very juſt encomium on the good ſenſe and general character of our Highland clergymen. 'The iſlanders,' he remarks, 'of all degrees, 'whether of *rank* or *underſtanding*, admit of it (*i. e.* the ſecond 'ſight) except the *miniſters*, who univerſally deny it, and are ſuſ-'pected to deny it, in conſequence of a *ſyſtem*, againſt *conviction.* 'One of them honeſtly told me, that he came to Sky with a *reſo-'lution* not to believe it †.'

It is not incurious to remark, that men, even poſſeſſed of diſtinguiſhed parts, when urging any favourite topic, frequently contradict themſelves, and, from abſolute nonſenſe, inadvertently recur to ſenſe. Of this, the following lines of Dr JOHNSON afford a ſtriking example: 'Strong reaſons,' ſays the Doctor, 'for incredulity will 'readily occur. This faculty of *ſeeing* things out of *ſight* is local, 'and commonly *uſeleſs*. It is a breach of the common order of 'things, without any *viſible* reaſon or *perceptible* benefit. It is 'aſcribed only to a people very little enlightened ; and among them, 'for the moſt part, to the *mean* and the *ignorant* ‡.' The celebrated author of theſe juſt obſervations was a firm believer in the exiſtence of *ſecond ſight !* 'The *foreſight* of the *ſeers*,' ſays Dr JOHNSON, 'is

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* Johnſon's Journey to the Weſtern Iſlands of Scotland, p. 152. Edin. edit. 1792.

† Ibid. p. 154.

‡ Id. ibid.

‘ is not always *preſcience:* They are impreſſed with images, of which ‘ the event only ſhews the meaning *.’

Dr JOHNSON admits what is well known to all our Highlanders, that the perſons ſaid to poſſeſs this faculty are, in general, ignorant, dozing, indolent creatures, who never work, ſpeak ſeldom, and ſpend whole days gaping and gazing ſtraight forward, without altering their poſition, or taking the ſmalleſt notice of what paſſes around them. The whole employment of their minds, it ſhould appear, is occupied with viſionary phantoms: It is not ſurpriſing, therefore, that they ſhould, at one time or other, ſtumble upon ſcenes or events, to which ſomething ſimilar afterward happens.

In the year 1779, the Reverend Mr DONALD M'NICOL publiſhed *Remarks* on Dr JOHNSON's Journey to the Hebrides, a book written with much ſpirit, good ſenſe, and acuteneſs of reaſoning. Being born and bred in the Highlands, Mr M'NICOL muſt be allowed to have had better opportunities of knowing the diſpoſitions, manners, and faith of his own countrymen, than a prejudiced Engliſhman, who was ſo *ſhort-ſighted*, that he could not *ſee* a *tree* in Scotland, though he paſſed many extenſive woods and groves, both natural and planted. To ſhow the light in which Mr M'NICOL viewed the narrative of the Doctor's Journey, I ſhall tranſcribe a few lines on the ſubject of *ſecond ſight*.

‘ In page 248. our traveller,’ Mr M'NICOL remarks, ‘ comes to ‘ examine the queſtion of the *ſecond ſight;* and it is truly ſurpriſing ‘ to ſee with what a *credulous weakneſs* he endeavours to defend ſo ‘ *viſionary* an opinion. Other things, which are believed by every

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* Johnſon's Journey, &c. p. 156.

‘ man in the country, which are probable in themſelves, and are ‘ ſupported by all the evidence that a reaſonable man could expect, ‘ the Doctor often *rejects*; but *this* point, *abſurd* in itſelf, uncountenanced by any *decent* authority, and to which only a few of the ‘ *moſt ignorant vulgar* give the *leaſt faith*, he maintains with a ‘ *zeal* which ſhews him to be *aſhamed* of nothing but *thinking* like ‘ *other* men *.’

Even on the ſuppoſition that ſuch a faculty as *ſecond ſight* exiſted, the queſtion may be aſked, *Cui bono?* For what end ſhould men be endowed with a power, which can only ſerve to torment them with unneceſſary alarms? Though we were enabled to ſee impending calamities, but deprived, as we are, of the capacity of preventing them, inſtead of a happy attainment, it would render us perpetually miſerable. The evils of human life are already ſufficiently numerous; and Nature, for wiſe purpoſes, has hid futurity from our eyes.

Like many other ſuperſtitions, that of *ſecond ſight* muſt vaniſh in proportion as knowledge and civilization advance; and it is a pleaſure to learn, that it is now nearly extinguiſhed even in the Weſtern Iſlands of Scotland.

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* M‘Nicol’s Remarks on Dr Samuel Johnſon’s Journey to the Hebrides, p. 191.

SECT. VI.

Of Somnambuliſts—Hiſtory of Two who fell under the Author's Obſervation.

ANOTHER remarkable phenomenon, which is ſometimes exhibited in ſleep, merits attention.—Some people, during ſleep, retain the faculties of ſeeing, hearing, ſpeaking, walking, laughing, crying, and, in general, doing almoſt every thing they are accuſtomed to perform when they are awake. Near thirty years ago, I had an opportunity of examining a ſtriking example of *ſomnambuliſm*. Within a mile of Edinburgh, I happened to reſide ſome time in a farmer's houſe. Mr BAIRD, my landlord, had a ſervant maid, whoſe name was *SARAH*. I was not long there, when I learned from the family, that SARAH, particularly after receiving an affront, or being angered, was accuſtomed to riſe in her ſleep, to go out, and to walk about the fields. My curioſity was excited; and I begged to be informed the firſt time that SARAH ſhould riſe in her ſleep. A few nights afterward, one of Mr BAIRD's ſons awaked me, and told me that SARAH had got out of bed. I immediately haſtened to the apartment where ſhe ſlept. When I arrived, Mr and Mrs BAIRD, one of their ſons, and a ſervant maid, SARAH's companion, were preſent. SARAH was in the midſt of them. She was ſlightly and careleſsly clothed. Her neighbour ſervant perſuaded her to ſit down. I took my ſeat by her. We began immediately to converſe. She anſwered any queſtions that were put to her pretty diſtinctly; but ſhe always miſtook the perſon who ſpoke for ſome other, which gave us an opportunity of aſſuming any character within the circle of her acquaintance. I knew that one of the farmer's ſervants, whoſe name was JOHN PORTEOUS, was a lover of her's; and, therefore, I addreſſed her in the ſtyle which I ſuppoſed JOHN might ſometimes have done. From that moment ſhe began to ſcold me, upbraided me with ſeveral breaches of promiſe to marry her, and deſired me, in the moſt peremptory manner, never again to ſpeak to her on that topic. The converſation was accordingly changed. I talked of her miſtreſs, who was in the room, becauſe I knew that they had occaſional quarrels. Till now, I ſuſpected that the whole was a trick, but for what purpoſe I could not diſcover. SARAH, however, abuſed Mrs BAIRD in the harſheſt terms. She ſaid, but the other day, ſhe had been accuſed of ſtealing and drinking ſome bottles of ale; that her miſtreſs was ſuſpicious, cruel, and narrow-minded. As the miſtreſs of the houſe was preſent, when theſe and other opprobrious terms were uſed, I began to doubt my preconceived notion of impoſture; and, therefore, changed the object of my experiments and inquiries. I examined her countenance, and found, that her eyes, though open, wild, and ſtaring, were not abſolutely fixed. I took a pin and repeatedly pricked her arm; but not a muſcle moved, not a ſymptom of pain was diſcoverable. At laſt, ſhe became impatient to get out, and made ſeveral attempts to eſcape by the door; but that was prevented by the domeſtics. Perceiving her inability to force the door, ſhe made a ſudden ſpring at the window, and endeavoured to throw herſelf over, which would have been fatal to her. To remove every ſuſpicion of impoſture, I deſired the people, with proper precautions to prevent harm, to try if ſhe would really precipitate herſelf from the window. A ſeemingly free acceſs was left for her eſcape, which ſhe perceived, and inſtantly darted with ſuch force and agility, that more than one half of her body was projected before her friends were aware. They, however, laid hold of her, and prevented the dreadful cataſtrophe. She was again prevailed upon, though with much reluctance, to ſit down. She ſoon reſumed her former calmneſs, and freely anſwered ſuch queſtions as were put to her. This ſcene continued for more than an hour. I was perfectly convinced, notwithſtanding my original ſuſpicions, that the woman was actuated by ſtrong and natural impulſes, and not by any deſign to deceive. I aſked if any of the attendants knew how to awaken her. A female ſervant replied, that ſhe did. She immediately, to my aſtoniſhment, laid hold of SARAH's wreſt, forcibly ſqueezed and rubbed the projecting bones, calling out, at the ſame time, SARAH, SARAH! By this operation SARAH awoke. She ſtared with amazement, looked around, and aſked, how ſo many people came to be in her apartment at ſo unſeaſonable an hour? After ſhe was completely awake, I aſked her, what was the cauſe of her reſtleſs and violent agitation? She replied, that ſhe had been dreaming that ſhe was purſued by a furious *bull*, who was every moment on the point of goring her.

A pretty ſimilar example afterwards occurred. Mr THOMAS PARKINSON, then a ſtudent of medicine in the univerſity of Edinburgh, was accuſtomed to talk and to anſwer queſtions in his ſleep. This fact was known to his companions. To amuſe ourſelves, two of us went gently into his chamber while he was aſleep. We knew that he was in love with a young lady in Yorkſhire, the place of his nativity. We whiſpered her name repeatedly in his ear. He ſoon began to toſs about his hands, and to ſpeak incoherently. He gradually

dually became more calm and recollected. His imagination took the direction we intended. He thought he was ſtationed under the lady's window, and repeatedly upbraided her for not appearing and ſpeaking to him as ſhe had ſo often done on former occaſions. At laſt, he became impatient, ſtarted up, laid hold of books, ſhoes, and every thing he could eaſily graſp. Thinking his miſtreſs was aſleep, he threw theſe articles againſt the oppoſite wall of his chamber. By what he ſaid, we learnt, that his imaginary ſcene lay in a ſtreet, and that he was darting the books and ſhoes at the lady's window, in order to awake her. She, however, did not appear; and, after tiring himſelf with frequent exertions, he went quietly into bed without wakening. His eyes were nearly ſhut; and, although he freely converſed with us, did not ſeem to perceive that any perſon was preſent with him. Next day, we told him what had happened; but he ſaid, that he had only a faint recollection of dreaming about his miſtreſs.

In the French Encyclopedie, under the word *Noctambule*, we have an account of a ſtudent of divinity in the univerſity of Bourdeaux, who was accuſtomed to riſe in his ſleep, and to read and write without the uſe of his eyes. The fact is atteſted by the Archbiſhop of BOURDEAUX, who thought it a phaenomenon worthy of his attention. Leſt he ſhould have been deceived by the young man, he interpoſed an obſtacle between his eyes and the paper on which he was writing, or reading. But he read and wrote in the ſame manner, and with equal accuracy, as if no ſuch obſtacle had exiſted *.

A recent and authentic occount of a ſleep-walker has been publiſhed ed on the continent, and now tranſlated into Engliſh under the title of *A true and ſurpriſing Account of a Natural Sleep-Walker, read before the Philoſophical Society of Lauſanne in Switzerland, on the 6th of February* 1788. This ſleep-walker's name is **Devaud**. At the time the following experiments and obſervations were made upon him under the direction of the ſociety, he was between thirteen and fourteen years of age. His conſtitution was weakly, and his nerves extremely irritable. The ſociety appointed three of its members, Dr **Levade** and Meſſrs **Reynier** and **Van Berchem**, to make and report their obſervations on the ſleeping exertions and behaviour of this young man. Theſe gentlemen faithfully executed the injunctions they had received, and reported the reſults of the experiments they had made, and whatever authentic relations they procured from others.

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* This fact is likewiſe related by the learned and ingenious Lord MONBODDO, in his *Antient Metaphyſics*, vol. I. p. 159.

His ordinary ſleep, which is ſeldom tranquil, when about to be ſeized with a fit of Somnambuliſm, is uncommonly diſturbed. While in this ſtate, he is affected with involuntary motions; his heart palpitates; his tongue faulters; and he alternately riſes up and lies down. On one of theſe occaſions, the gentlemen remarked, that he ſoon articulated more diſtinctly, roſe ſuddenly, and acted agreeably to the motives of the dream which then occupied his imagination. When too quickly rouſed by a violent noiſe, or other cauſes, he is ſometimes ſeized with convulſions. After a paroxyſm, he complains of being fatigued, and, on ſome occaſions, is affected with ſickneſs and vomiting. At firſt, when he awoke, and found himſelf dreſſed, and in the midſt of ſeveral perſons, his ſurpriſe was great. But, after the habit of ſomnambuliſm had continued for ſome time, recollection of ſimilar events, as formerly remarked with regard to diſagreeable dreams, gradually diminiſhed his ſurpriſe. The ideas of a boy at ſchool muſt neceſſarily be few and ſimple; and, of courſe, his dreams can admit of little variation. His daily verſions, cyphering, the church ſpires, and bells, but chiefly tales of ghoſts and hobgobblins, were the principal objects of his nightly viſions. When his mind was impreſſed with particular ideas before going to ſleep, which is nothing uncommon, theſe ideas frequently conſtituted or gave a direction to his dreams.

The gentlemen examinators mention ſome effects of electricity and magnetiſm upon our ſomnambuliſt. But, in the tranſlation, (for I have not ſeen the original), the facts are obſcure, unintereſting, and ſometimes even contradictory; and, therefore, ſhall be paſſed over in ſilence.

With regard to the young man's *ſenſes*, we are told, that iron, braſs, and ſilver, applied to his noſtrils, made no impreſſion; but that a bit of cedar, as well as the fingers of another perſon, gave him ſome uneaſineſs. In one of his paroxyſms, they preſented to him a piece of bread, and ſome wormwood wine. The latter he immediately diſtinguiſhed by the ſmell, and ſaid, *This is not our table wine.* He was afterwards furniſhed with a little common wine, which he inſtantly drank. As he was walking along, wrapt up in ſome dream, two of the gentlemen put themſelves in the way he was directing his courſe; but he paſſed between them, without being offended, or ſeeming to be conſcious of the preſence of any obſtacle. He dreſſed himſelf with great propriety in a room which was perfectly dark: He ſelected his own clothes from a number of others which had been purpoſely jumbled together, and complained that ſome of his companions had made ſport of him. When his eyes were perfectly ſhut, he touched, in preſence of the gentlemen, ſeveral objects, and readily diſtinguiſhed thoſe which he had ſeen before from thoſe he had not. A book that did not belong to him was put into a drawer where he kept his papers: When he felt the book, he expreſſed great anxiety leſt he ſhould be ſuſpected of theft.

His ſenſe of *hearing* while aſleep was very accurate. In one of his reveries, he fancied that he was ringing the bell of St Martin's church, and performed all the neceſſary motions. After this operation was finiſhed, he was aſked how long he had rung? he anſwered, *four minutes*. He took a candle with a deſign to light it: But one of the company, not perceiving that he held it in his hand, remarked in a low voice, that *he had forgot his candle*. *Of what uſe are your eyes*, ſaid DEVAUD, *if you don't ſee it?*

When our ſleep-walker wiſhes to *ſee* any object, he makes an effort to open his eye-lids, which he does very imperfectly, and with much difficulty. The ball of the eye, on theſe occaſions, appears to be fixed and languid. On this ſubject Mr N. —— makes the following remarks: 'When I accompanied the ſleep-walker, I remained 'always behind him, or by his ſide; and very often without touching him. I put my face under his, to obſerve if his eyes were 'really ſhut; and I found them always cloſed. However, after 'walking ſome ſteps in this poſture, he uſually diſcovered me by the 'noiſe of my feet, and went a little aſide. When I ſtill followed 'him, he raiſed his head, drew up his eye-brows with difficulty, and 'made an effort to open his eyes. This he could do only by halves, 'yet ſo as to perceive me: *Don't ſtand in my way*, he ſaid, and held 'on at the ſame pace. As the moon ſhone, I had an opportunity of 'examining his eyes very narrowly, and was convinced, that the difficulty he experienced in opening them proceeded from the inaction

‘ of the upper eye-lid, which he could not move without firſt raiſing ‘ the eye-brows *.’

The gentlemen examinators made many other experiments upon this ſleep-walker. But as, in general, they are of a ſimilar nature with thoſe already related, it is unneceſſary to give more examples.

Upon this curious ſubject, I muſt mention a ſingular converſation which happened in my houſe many years ago. The company conſiſted of the learned and ingenious Dr **Reid**, at preſent Profeſſor of Morals in the Univerſity of Glaſgow, and the no leſs learned and ingenious Dr **Blacklock**, both well known in the literary world. Dr **Reid**, among many other queſtions, aſked Dr **Blacklock**, if he had any idea of light? Dr **Blacklock** replied, that he had not, being deprived of ſight ſo early as the ſecond year of his exiſtence. Dr **Reid** then aſked him, if there was any difference between his ideas of perſons and objects when he *dreamed*, and thoſe which were excited while awake? Dr **Blacklock** replied, that the difference was great; that he doubted whether he could communicate this difference in ſuch a manner as to be underſtood; but that he would make the attempt. His anxiety to pleaſe and inform made his explanation at firſt ſo obſcure and perplexed, that it could not be underſtood. This perplexity he perceived; retracted what he had ſaid as unintelligible; and, with ſome degree of exultation, exclaimed, ‘ Now I have it.’ He then told us, that, when awake, he could diſtinguiſh perſons three ways: The moſt perfect of which was that of hearing them ſpeak; but he could alſo recogniſe an acquaintance by feeling his head and ſhoulders. The third mode of diſtinction was by attending, without the aid of ſpeech, to the ſound and manner of breathing. He then proceeded, and told us, that, in ſleep, the objects which preſented themſelves to his imagination were more vivid, and that without the intervention of any of the three modes mentioned above, he had diſtinct perceptions of *diſtant objects* both animated and inanimated. Being aſked by what means he thought theſe impreſſions were conveyed to him, he replied, that he imagined his body was united to theirs by a kind of *diſtant contact*, which was effected by the inſtrumentality of *threads* or *ſtrings* which proceeded from their bodies to his own; and that mutual ideas were conveyed by *vibrations* of theſe *ſtrings*. The Doctor could not come nearer to the point; for, though what he ſaid did not amount to ideas excited by actual *viſion*, yet the approach was aſtoniſhingly near.

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* See the above mentioned Pamphlet, p. 25.

SECT. VII.

Some unconnected Facts concerning Sleep and Dreaming.

MAN is not the only animal that dreams. From many facts, and a very extenſive analogy, it is almoſt certain, that every animal dreams more or leſs. Dogs bark in their ſleep. This barking is indeed feeble; but the ſounds peculiar to the chace, to anger, to deſire, to complaint, &c. are eaſily diſtinguiſhable. I have often regretted, that ingenious men, when ſupporting favourite theories, ſhould ſo frequently relate the groſſeſt abſurdities. The celebrated M. DE BUFFON, *in his Diſſertation on the Nature of Animals*, gravely tells us, ‘ that *idiots*, whoſe *minds* are totally *inactive*, *dream* ‘ like other men : *Dreams*, therefore, are produced independent of ‘ *mind*. Brute animals, though they have *no mind*, not only *dream*, ‘ but I am tempted to think, that all *dreams* are independent of ‘ *mind* *.’ A moſt brilliant ſentiment, and moſt *logically* expreſſed ! Dreaming, thinking, or even feeling, without the intervention of *mind*, involve ideas beyond the limits of human underſtanding.

When about to ſleep, moſt animals chuſe a particular poſition of body. The camel places his head between his fore feet; the monkey, like

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* Buffon, vol. 3. p. 256. Tranſlat.

like man, lies on his ſide; moſt birds ſleep with their head under one wing. The pſittacus galgulus, a ſpecies of parrot, hangs by one foot on the branch of a tree; and ſome ſpiders, and other inſects, ſuſpend themſelves by their fore legs.

A horſe, when in good health, lies not above two or three hours at a time, and ſeldom ſleeps more than three or four hours in the twenty-four. Some horſes never lie down, but ſleep ſtanding; and even thoſe which are accuſtomed to lie down, ſometimes ſleep on their feet. The aſs ſleeps ſtill leſs than the horſe; and, for that purpoſe, never lies down, except after great fatigue *. The heavieſt and moſt ſluggiſh animals do not ſleep the longeſt or the moſt profoundly. The ſlumbers of the ox are light and ſhort. He is rouſed by the ſlighteſt noiſe: He generally lies on the left ſide; and the left kidney is always larger and fatter than the right †. The ſleep of cats, is, in general, light; but ſometimes they have been ſeen ſleeping with much more profoundneſs than moſt other animals ‡. The ſow-kind ſleep longer than moſt quadrupeds.

Man, perhaps, ſleeps longer than any of the larger animals. Beſide the natural waſte occaſioned by exerciſe and labour, the perpetual activity of his mind fatigues the body, and renders a greater quantity of ſleep neceſſary.

Badgers ſleep the whole night and three-fourths of the day; yet, like the marmottes or dormice, they are ſubject to a lethargic or benumbed ſtate during winter. This great quantity of ſleep, though they eat little, makes them very fat; for this reaſon, they are enabled to

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* Buffon, ibid. p. 416.

† Ibid. p. 442.

‡ Ibid. vol. 4. p. 55.

to endure hunger a long time, and often remain in their holes three or four days together, without receiving the ſmalleſt nouriſhment.

Another affection, peculiar to the ſtate of ſleep, is the *incubus*, or *night-mare*. This affection, in general, is produced by indigeſtion, and by eating too much, and particularly of fleſh-meat, at ſupper. It is likewiſe ſometimes occaſioned by lying, while aſleep, on the back, and the bed-clothes, of courſe, preſſing on the breaſt. From whatever cauſe the *night-mare* proceeds, it is uniformly accompanied with great terror, and a ſenſe of ſuffocation; for by the preſſure of wind, or ſome other cauſe, upon the lungs, reſpiration is either prevented, or very much impeded. The ſenſations excited by this cauſe are always of the moſt excruciating nature. The imagination preſents the ideas of ſome ſpectre or demon lying on the breaſt, or of ſituations which neceſſarily infer ſuffocation and death. When the ſufferer attempts to throw off the load, or to eſcape from the impending danger, he diſcovers a total inability to move any of his members. This circumſtance augments his terror and his pain, and, at laſt, baniſhes ſleep. When he awakes, the imaginary weight, or cauſe of terror, is removed, and the power of motion is reſtored. But the palpitations of the heart, and the confuſion of the brain, remain for ſome time, till the paroxyſm is completely finiſhed; and then the whole is recogniſed to have been only an imaginary deluſion *.

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* If the reader is deſirous of ſeeing a more full diſcuſſion of this ſubject, he may conſult Dr Willis, *De Anima Brutorum*, a learned and ingenious work, publiſhed in the year 1672.

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CHAPTER VI.

Of thoſe Animals who ſleep, or continue in a torpid ſtate, during Winter.

THAT ſtate of animal exiſtence denominated *ſleep*, may be conſidered as an univerſal affection. Almoſt every animated being is ſubject to its dominion. As formerly remarked, ſome animals require more and others leſs ſleep, according to their conſtitutions and other circumſtances. But there are many animals who continue to ſleep during the whole months of winter. While in this condition, they neither move nor take food; and yet they revive on the approach of ſummer. Of theſe a few examples ſhall be laid before the reader.

It is well known, that many quadrupeds and inſects remain in a torpid ſtate during winter; but it is a remarkable fact, that not a ſingle ſpecies of birds, except the ſwallow and cuckoo, have ever been ſuppoſed to ſleep during the winter months. With regard to the ſwallow-tribe, I muſt refer the reader to my firſt volume, where this ſubject is amply diſcuſſed *.

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* Philoſ. of Nat. Hiſt. vol. 1. p. 473.

The land-tortoiſe is a very long-lived animal. Mr WHITE * gives an account of one that lived more than forty years in a little walled court. During that period, it regularly retired under ground about the middle of November, and came forth again about the middle of April. On its firſt appearance in the ſpring, it diſcovered very little inclination for food; but, in the height of ſummer, it was very voracious. As the ſummer declined, its appetite grew leſs; and, during autumn, it hardly ate any thing. In the month of April 1780, Mr WHITE informs us, 'a moiſt and warm afternoon, with 'the thermometer at 50, brought forth troops of *ſhell-ſnails*; and, 'at the ſame juncture, the *tortoiſe* heaved up the mould and put out 'its head; and the next morning came forth, as it were raiſed from 'the dead, and walked about till four in the afternoon †.'

The *Alpine marmots*, on the approach of winter, retire to their ſubterranean abodes, the entrances to which they ſhut up with earth or clay. In this ſituation they continue to be plump for three months; but afterwards they gradually decay, and are extremely emaciated at the end of winter. When diſcovered in their retreats, they are found to be rolled up in the form of a ball, covered with hay; and they are carried off by the hunters in a ſtate ſo torpid, that they may be killed without ſhowing the ſmalleſt ſymptom of pain. They may be revived by a gradual and gentle heat; and thoſe which are tamed and fed in houſes never become torpid, but are as lively and active in the winter as in the ſummer. Their holes are deep, and they live together in numbers. The fatteſt are ſelected for eating, and the young ones are preſerved for taming ‡.

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* White's Nat. Hiſt. of Selborne, p. 135, &c.

† Ibid. p. 262.

‡ Buffon, vol. 4. p. 344. Tranſlat.

The different ſpecies of *bats* ſleep during the winter months. The final cauſe of their torpidity is obvious. In that ſeaſon, there are no moths, or other flying inſects, the chief food of bats. Hence, if Nature did not confer this faculty, or rather inactivity, upon them, a ſingle winter would annihilate the ſpecies. ‘ The prevailing notion,’ ſays the Honourable DAINES BARRINGTON, ‘ that they ‘ hang always in cluſters touching each other, is not true, as this ‘ depends entirely upon their having a proper opportunity of adhering to the place from which they are ſuſpended; they ſometimes, ‘ therefore, are in contact, and often at conſiderable diſtances, but ‘ always fix themſelves by both their feet [*].’ It is a well known fact, that bats, whilſt in a torpid ſtate, evacuate their dung, and, of courſe, both the circulation of the blood, and a certain degree of muſcular action, continue to be exerted. Mr CORNISH applied a thermometer to the body of a bat when perfectly torpid; the liquor ſtood at 36, and the heart beat 60 times in a minute. When awakened ſo much that the ſame animal could fly a little, the thermometer was again applied, the liquor roſe to 38, and the heart beat 100 times in a minute.

Some animals who ſleep during winter, may be kept awake by ſupplying them with warmth and proper food. Of this kind are the bear, the viper, and the common houſe-fly, which, under theſe circumſtances, continue alert and cheerful through the whole year.

The *fat ſquirrel*, a quadruped about ſix inches in length, the *ſciurus glis* of LINNÆUS, remains in a torpid ſtate during winter. Its internal heat exceeds not that of the air. When the heat of the air is ten degrees above the freezing point, the temperature of the *fat ſquirrel*,

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[*] Daines Barrington's Miſcellanies, p. 166.

ſquirrel, the *dormouſe*, and the *garden ſquirrel*, is preciſely the ſame, as M. de BUFFON diſcovered by plunging the ball of a thermometer into their bodies. We cannot, therefore, be ſurpriſed that theſe animals, whoſe natural heat is ſo inconſiderable, ſhould fall into a benumbed ſtate, whenever their internal heat is not augmented by that of the external air, which uniformly happens when the liquor in the thermometer does not riſe ten or eleven degrees above the freezing point. Cold is the true cauſe of the torpid ſtate of what are called the *ſleeping* animals. This torpid ſtate continues as long as the cauſe by which it is produced, and ceaſes with the cold. A few degrees above ten or eleven is ſufficient to revive them; and, if kept in a warm place during winter, they are never benumbed, but go about, and eat and ſleep like other animals. When they feel uncommonly chilled, in order to expoſe leſs ſurface to the air, and to preſerve their natural warmth, they roll themſelves up in the form of a ball. It is in this form that they are found, during winter, in hollow trees, and in holes of walls expoſed to the ſouth. In theſe holes they lie upon collections of moſs and leaves, without the ſmalleſt motion; and, though toſſed about, they neither extend themſelves, nor diſcover the leaſt ſymptom of life. From this dormant condition nothing can rouſe them but the application of a gentle and gradual heat; for, when ſuddenly placed near a fire, they uniformly die. Though, in this ſtate, they are totally deprived of motion, though their eyes are ſhut, and the animals ſeem to have loſt every ſpecies of ſenſation; yet they feel any acute pain. When burned or wounded, they contract their bodies, and utter low and repeated cries. Their ſenſibility, therefore, and the action of the heart and lungs, ſtill ſubſiſt. It is obvious, however, that theſe vital motions are but feeble. The circulation of the blood, it is probable, proceeds in the large veſſels only; for the reſpiration is ſlow and feeble, the ſecretions are inconſiderable, and no excrements are voided. In long and rigorous winters, they ſometimes die in their holes. They periſh not, it ſhould appear, by the loſs of ſubſtance from perſpiration; for in autumn they are exceedingly fat; and equally ſo when they revive in the ſpring. As cold is the chief, if not the only cauſe of their torpor, and as they do not fall into this ſtate till the temperature of the air is below ten or eleven degrees, they frequently revive during the winter; for, in that ſeaſon, many days often occur when the liquor in the thermometer riſes to twelve, thirteen, fourteen, and even higher degrees above the freezing point. In weather of this kind, the dormice either come out of their abodes in queſt of food, or eat part of what they had amaſſed in autumn.

The *Hamſters*, or German marmots, on the approach of winter, retire into their ſubterraneous abodes, where they remain in perfect tranquillity, and feed on their proviſions till the froſt becomes ſevere, when they ſink into a torpid ſtate. During this period of their exiſtence, if the holes be opened, the hamſter is found lying on a bed of ſtraw. His head is bended under his belly between the two forelegs, and thoſe behind reſt upon his muzzle. The eyes are ſhut; and, when the eye-lids are forced open, they inſtantly cloſe again. His members are ſtiff, like thoſe of a dead animal, and the whole body feels as cold as ice. Neither reſpiration, nor any other ſign of life, can be perceived. When diſſected in this ſituation, the heart alternately contracts and dilates. Theſe movements, however, are ſo ſlow, that the pulſations do not exceed fifteen in a minute; though, when the animal is awake, the heart, in the ſame time, beats an hundred and fifty ſtrokes. The fat ſeems to be coagulated. The inteſtines are equally cold with the external parts of the body, and, upon the application of ſpirit of wine, or oil of vitriol, diſcover not the ſmalleſt degree of irritability. During this operation, the animal ſeems to have very little feeling. As if he wanted to reſpire, he ſometimes opens his mouth. But his torpor is too powerful to admit of his awaking entirely.

This lethargy of the hamſter has been aſcribed ſolely to the effects of a certain degree of cold, which may be true with regard to the bats and dormice; but, in order to render the hamſter torpid, beſide cold, he muſt likewiſe be excluded from all communication with the external air: For, when ſhut up in a cage, filled with earth and ſtraw, and expoſed to a degree of cold ſufficient to freeze water, the hamſter never becomes torpid. When the cage, however, is ſunk four or five feet under ground, and ſecured againſt the acceſs of air, in a few days, he is equally torpid as if he had been in his own burrow. If the cage is brought up to the ſurface, the hamſter, in two or three hours, awakes, and reſumes his torpid ſtate when again put under the earth. When paſſing from a torpid to an active ſtate, the hamſter firſt loſes the rigidity of his members, and then makes profound reſpirations, but at long intervals. His legs begin to move, he opens his mouth, and utters rattling and diſagreeable ſounds. After continuing theſe operations for ſome time, he opens his eyes, and endeavours to raiſe himſelf on his legs. All theſe movements, however, are ſtill unſteady and reeling, like that of a man intoxicated with liquor. But he reiterates his efforts, till he acquires the faculty of ſtanding on his legs. He remains, for ſome time, fixed in that attitude, as if he meant to reconnoitre, and to repoſe himſelf after his fatigue. He now gradually begins to walk, to eat, and to act in his uſual manner. According to the temperature of the air, this paſſage, from a torpid to an active ſtate, requires more or leſs time. In a cold air, he is generally more than two hours before he completely awakes; but, in a more temperate air, he accompliſhes this purpoſe in leſs than one hour. It is probable that this change is produced imperceptibly when the animal remains undiſturbed in his hole, and that he feels none of the inconveniencies which ariſe from a forced and ſudden reviviſcence *.

The *Hedgehog* is one of thoſe quadrupeds which lie in a dormant ſtate during the winter months. Some years ago, that ingenious, learned, and dexterous anatomiſt, Dr ALEXANDER MONRO, made ſome experiments upon the hedgehog, as well as upon frogs, though he informs me †, that he did not proſecute theſe experiments with all the accuracy and attention which the curioſity of the ſubject merits. During a ſevere winter, he kept a hedgehog in a room, where there was no fire from the month of November till March. He placed near the animal boiled beef, bread, cheeſe, potatoes, water, and ſtraw. About the beginning of December 1764, the hedgehog was affected with an unuſual degree of drowſineſs. He, however, continued to eat, though more ſparingly, till the 25th of that month. From that time till the 8th day of March following, he continued in a profound ſleep, except when artificially rouſed. After being thus rouſed, he ſoon walked back to his place of retreat, and reſumed his dormant ſtate. On the 25th of December, he weighed thirteen ounces and three drachms; on the 6th of February eleven ounces and ſeven drachms; and, on the 8th of March, eleven ounces and three drachms. The Doctor obſerved a ſmall quantity of feculent matter and urine among the hay. At the time of his actual reviviſcence, no perſon was preſent; and, of courſe, the circumſtances attending it are unknown. In the courſe of three months, he did not perceive that

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* For theſe and ſimilar facts, ſee Buffon and many other natural hiſtorians.

† In a letter, dated March 1794.

that the hedgehog had either ate or drank; but it remained conſtantly in a profound ſleep among the ſtraw. Its limbs, however, were never rigid; but it loſt two ounces of its weight. *Frogs*, which the Doctor kept during the winter in a veſſel with water, ſeemed to be in a ſimilar ſtate with that of the hedgehog.

From every example we have enumerated, it appears, that extreme cold, and an excluſion from a free acceſs to the operation of the external air, are the principal cauſes which produce the torpidity of certain brute animals. We ſhall now make a remark upon what happens to the human ſpecies when expoſed to great cold, eſpecially if accompanied with bodily fatigue. Men in this ſituation, of which fatal inſtances too often occur, feel an almoſt irreſiſtible inclination to lie down to reſt. When they yield to this propenſity, being benumbed with cold, they ſoon fall aſleep; and this ſleep infallibly terminates in death. Thoſe animals, however, who ſleep during the winter, uniformly not only retire below ground, or into ſome other receſs, but cover themſelves with ſubſtances which reſiſt ſuch deleterious effects of cold as would deſtroy their exiſtence. If man and the larger animals, when benumbed and actually aſleep from the operation of cold, were placed in ſimilar circumſtances, it is probable they might be induced to ſleep a very great length of time, and again awake without ſuffering much injury.

CHAPTER VII.

Of the Language of Beaſts.

UNDER the term *beaſts*, in the courſe of this chapter, I comprehend all thoſe animals, of every claſs, who are inferior in mental powers to the human ſpecies. We can only perceive the language of beaſts by attending to the particular cries they make, and to the influence which theſe cries have upon the feelings and actions of their aſſociates. This ſubject is very copious. But I muſt limit myſelf to a few facts, accompanied with ſuch remarks as they may occaſionally ſuggeſt.

I ſhall begin with the claſs of quadrupeds. But it is neceſſary to inform my readers, that by the *language of beaſts*, I mean not what is called *articulate* or *artificial* language, but ſuch vocal *ſounds* as are expreſſive of different feelings, wants, and deſires, by which animals are enabled to communicate particular ſentiments to each other.

In oppoſition to *artificial* language, the nature of which depends upon convention or agreement, and ſometimes upon mere accident, there is a *natural* language which is common to man and to moſt of the inferior animals. Men poſſeſs both theſe ſpecies of language; but the brute animals are limited ſolely to natural language. Brutes, by uttering certain ſounds, are enabled to communicate their feelings, whether external or internal, to every individual of the ſame ſpecies. Theſe aſſemblages of inarticulate ſounds are uniformly the ſame, and, contrary to what takes place in the artificial language of man, ſuffer no variation from climate or inſtitution, but are equally intelligible in every diviſion of the globe.

The *elephant* loves the ſociety of his equals, and can make himſelf to be underſtood by them. Elephants are often obſerved to aſſemble in troops, to act in concert, and again to diſperſe. Theſe movements are not accidental, but produced by certain ſounds and geſtures; and, though they carry on no common operation, this circumſtance may, perhaps, be aſcribed to the want of room and of tranquillity; for, in all countries inhabited by the elephant, men have been very antiently multiplied; he is, therefore, perpetually diſturbed, and no where poſſeſſes peaceably ſufficient ſpace to eſtabliſh ſecure and permanent abodes. Elephants, in a wild ſtate, are neither ſanguinary nor ferocious. Their natural diſpoſitions are gentle, and they never make an improper uſe of their arms or their ſtrength; for they exert their offenſive talents only in defending themſelves, or in protecting their companions. Their manners are ſocial. They commonly march in numerous troops; the eldeſt precede; the young and the feeble are placed in the middle; and thoſe of middle age and full of vigour bring up the rear. The mothers carry their young firmly embraced in their trunks. This order, however, they obſerve in perilous marches only, as when they intend to paſture on cultivated fields. In the deſerts and foreſts, they travel with leſs precaution, but never ſeparate ſo far as to exceed the poſſibility of receiving aſſiſtance from each other. When alarmed with any dangerous attack, they utter *cries* expreſſive of their ſituation and want of aſſiſtance. The meaning of theſe cries is perfectly underſtood by all the elephants within the reach of hearing; and they immediately run with eagerneſs to the relief of their diſtreſſed or apprehenſive companions. When an elephant diſcovers a plentiful paſture, he *calls* to the others, and invites them to partake of his good fortune. From the great ſagacity with which Nature has endowed him, he ſoon becomes acquainted with the language, geſtures, and deſires of men. He is, of courſe, eaſily tamed, inſtructed, and rendered ſubmiſſive and obedient. As he is ſtronger as well as more intelligent than any other animal, his ſervices are more ready, more extenſive, and more uſeful. When the hunters go in queſt of a wild elephant, they carry along with them into the foreſt a tamed female in ſeaſon; and, when they imagine themſelves to be near enough to be heard, her governour makes her utter the *cry* of love. The wild male inſtantly *replies*, and haſtens to join her. She is then made to march towards an incloſure, pitfal, or other ſnare, repeating, from time to time, the ſame alluring cry, till he is completely deceived and caught. In a domeſtic ſtate, the elephant ſoon learns to underſtand ſigns, and even the meaning of words, ſounds, and geſtures. He diſtinguiſhes the tones of command, of anger, and of approbation, and regulates his actions accordingly. He never miſtakes the voice of his maſter; but receives his orders with attention, executes them with prudence and alacrity, but without any degree of precipitation; for his movements are always meaſured, and his character ſeems to partake of the gravity of his maſs. After this animal has had time to learn the *language* of his conductor, *words* alone are ſufficient to make him perform whatever is required of him. The eyes of the elephant, in proportion to the magnitude of his body, are very ſmall, but lively, brilliant, and highly expreſſive of ſentiment. He turns them ſlowly and with mildneſs towards his maſter. When he ſpeaks, the animal regards him with an eye of friendſhip and attention; and his penetrating aſpect is conſpicuous when he wants to anticipate the inclinations of his governour. He reflects, deliberates, thinks, and never determines till he has ſeveral times examined, without paſſion or precipitation, the ſigns or commands which he ought to obey. As the elephant is naturally grave and moderate, we eaſily read in his eyes, whoſe movements are ſlow, the order and ſucceſſion of his internal affections. The *cry* of the elephant, whether excited by love or other ſenſations, is heard and underſtood at the diſtance of more than a league; but it does not, like the roaring of the lion or tyger, create terror. When the *cornack*, or conductor of the elephant, wiſhes to have ſome laborious office performed, he explains the nature of the operation, and mentions the reaſons which ſhould induce him to obey. If the elephant ſeems reluctant, his conductor promiſes to give him arrack, or ſome other thing of which he is fond. But it is extremely dangerous to break any of theſe promiſes. Many cornacks have fallen victims to indiſcretions of this kind. A well authenticated fact, on this ſubject, happened at Dekan. An elephant, from ſome motive of revenge, killed his cornack. The man's wife, who beheld the dreadful ſcene, took her two children and threw them at the feet of the enraged animal, ſaying, 'Since you have ſlain my huſband, take 'my life alſo, as well as that of my children.' The elephant inſtantly ſtopped, relented, and, as if ſtung with remorſe, took up the eldeſt boy with its trunk, placed him on its neck, adopted him for its cornack, and would never afterwards allow any other perſon to mount it.

Among the larger ſpecies of animals, the *camel*, the *dromedary*, the *horſe*, &c. not only expreſs, by particular ſounds, their own wants, or deſires, their pleaſures and pains, but, when in a domeſtic ſtate, learn the meaning of *words*, and know diſtinctly how to obey the commands of their maſters. A troop of camels, when travelling in the ſandy deſerts of Africa, after a repoſe, the moment they are *deſired*, bend their knees, and lie down to be again loaded. Theſe gentle and inoffenſive creatures muſt ſuffer much; for, eſpecially when over-loaded, or when too long in want of water, they expreſs their uneaſineſs by uttering the moſt lamentable cries. In marching through the deſert, the camels require neither whip nor ſpur; but, when they begin to be tired, their courage is ſupported, and their fatigue is ſoftened, by *ſongs*, or by the ſound of ſome muſical inſtrument. Their conductors relieve each other in ſinging. When time is likely to be too much prolonged, the animals are occaſionally allowed to reſt only about an hour; after which, the ſongs are renewed till they arrive at another reſting place, when they again lie down. In this manner, and by theſe means, the camels, with heavy loads, perform journies almoſt incredible.

The language of the *horſe* is not extenſive. Mares and geldings neigh leſs frequently than perfect horſes. Their voices alſo are neither ſo deep nor ſo full. In horſes of every kind, whether entire or mutilated, five ſpecies of neighing, expreſſive of different paſſions, are diſtinguiſhable. In the neigh of *joy*, the voice is long protracted, and begins and terminates with ſharp ſounds: The horſe, at the ſame time, flings, but without any inclination to ſtrike. In the neigh of *deſire*, whether proceeding from love or friendſhip, the horſe does not fling, the voice is long continued, and finiſhes with graver tones. The neigh of *anger*, during which he flings and ſtrikes with fury, is very ſharp and ſhort. Neither is the neigh of *fear*, during which he likewiſe flings, longer than that of anger; the voice is grave and hoarſe, and ſeems as if it proceeded entirely from the noſtrils. This neigh has ſome reſemblance to the roaring of a lion. The noiſe expreſſive of *pain* is not properly a neigh, but a kind of groan or ſnorting uttered with a grave tone, and following the alternate motions of reſpiration. It has been remarked, that horſes which neigh moſt frequently, from motives of joy or deſire, are the moſt generous and healthy. The voice of unmutilated horſes is ſtronger than that of geldings or of mares. The female voice, even from the moment of birth, is weaker than that of the male. At two, or two and a half years, which is their age of puberty, the voices of both males and females, as in man and moſt animals, become ſtronger and more grave. In that large and thinly peopled country, comprehended between the rivers Don and Nieper, in the Ukraine, and among the Coſſacks, the wild horſes aſſociate in troops of three, four, or five hundred. The conduct and behaviour of theſe troops ſeem to indicate, that men are not the only animals who live in ſociety and obey, by compact, the commands of one of their own number. Each of theſe troops have a chief to whom they give implicit obedience. By geſtures, movements, and *voice*, he directs their courſe, and makes them proceed or ſtop at his pleaſure. When the troop is attacked by robbers, or by wolves, this chief likewiſe gives *orders* for the neceſſary arrangements and actions. He is extremely vigilant and alert, runs frequently round the troop, and, when he finds any horſes out of their rank, or lagging behind, he commands and obliges them to take their proper ſtations. Theſe animals, without being mounted or conducted by men, march in nearly as good order as our trained cavalry. Though at perfect liberty, they paſture in files and brigades,

gades, and form different companies, without ever mixing or ſeparating. The chief occupies this important and laborious office four or five years. When he becomes weaker, and, of courſe, leſs active, another horſe, ambitious of command, and who is conſcious of his own ſtrength, ſprings out from the troop, attacks the old chief, who, if not vanquiſhed, keeps his command; but, if beat, he enters, with evident marks of ſhame and regret, into the common herd. The conqueror inſtantly takes the lead, is recogniſed as ſovereign, and obeyed by the whole troop*.

With regard to the *ox-kind*, their language is very limited. The bull ſeldom bellows but when he feels the ardours of love, and the female perfectly underſtands the meaning of what he *utters*. When ſtrangers appear in his paſture grounds, he eyes them with ſuſpicion, utters deep-toned murmurs, aſſumes a threatening aſpect, and ſometimes runs furiouſly at the intruders. Theſe menacing tones and geſtures are not, as generally imagined, indications of a natural ferocity of diſpoſition. On the contrary, they are the expreſſions of heroiſm and of gallantry. By the ſounds he utters, the females are alarmed and put upon their guard. They approach near him, and regard him as their protector and champion. The lowings of the cow proceed oftener from terror or timidity than from any other cauſe; and pain, hunger, or the abſence of the mother, produce the complaints of the calf.

Sheep have been repreſented by the COUNT DE BUFFON and by many other natural hiſtorians, as the moſt ſtupid of all quadrupeds.

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* See deſcrip. de l'Ukraine par Beauplan, and a Memoir communicated to the Count de Buffon by M. Sanchez, formerly phyſician to the Ruſſian army.

This charge, however, ſeems not to be altogether juſt. In a ſtate of ſubjection, individuals ſeldom reſiſt the attacks of an enemy. But they ſoon learn that their protection lies in the ſhepherd and his dog; for, when it is neceſſary to watch the flock, in order to prevent the aſſaults of wolves, foxes, or dogs, upon the firſt alarm, the whole run with violence to the place where the watchmen are ſtationed. On other occaſions they never chooſe to make a very near approach either to men or dogs; but the ſenſe of immediate danger removes their uſual timidity, and their ſagacity teaches them where to ſeek protection. Theſe aſſociated movements are effected both by imitation and by peculiar *cries*, or bleatings, expreſſive of alarm and of danger; for, though a very few individuals only perceive the common enemy, yet, by motion and language, the intimidating ſentiment is in a moment communicated to the whole. When the female loſes or is robbed of her lamb, ſhe *cries* in a manner ſtrongly expreſſive of the anguiſh ſhe feels. In the eagerneſs of her ſearch, the loudneſs of her complaints, and her deſultory movements, her eye-balls ſeem to ſtart from their ſockets; and her irregular and diſtracted motions and diſtortions, joined to the violence and conſtancy of her bleatings, are evident indications of the moſt pungent grief. A young lamb, when it wanders from its mother, in the midſt of the moſt numerous flocks, runs precipitantly about, and *cries* in pitiable tones. Theſe *cries* the mother recogniſes, diſtinguiſhes them to be thoſe of her own offspring, and inſtantly joins the lamb; their congreſs is attended with mutual expreſſions of the greateſt joy.

With regard to mental and corporeal powers, the *goat* is much ſuperior to the ſheep. He approaches man ſpontaneouſly, and is eaſily rendered familiar. He is fond of careſſes both by the hand

and by *words*, and is capable of a conſiderable degree of attachment to thoſe with whom he is familiar. When kept, like dogs or cats, in a domeſtic ſtate, the whole powers of the goat are called forth. He utters *ſounds* expreſſive of all his deſires, and underſtands, in a limited degree, what is *ſaid* to him by any of the family, as well as by all thoſe who live in the neighbourhood. When he has remained ſome time in this ſtate, his natural talents are unfolded and improved in a high degree. He knows perſonally every man, woman, child, and dog, within his uſual range. His natural genius, which is bold and adventurous, when improved by domeſtication, renders him often frolicſome and even petulant. But, except to ſtrangers, he is ſeldom ſeriouſly miſchievous.

The natural ſagacity and talents of the *dog* are well known and juſtly celebrated. But, when theſe are improved by aſſociating with man, and by education, he becomes, in ſome meaſure, a rational being. The ſenſes of the dog, particularly that of ſcenting diſtant objects, give him a ſuperiority over every other quadruped. He reigns at the head of a flock, and his *language*, whether expreſſive of blandiſhment or of command, is better heard and better underſtood than the *voice* of his maſter. Safety, order, and diſcipline are the effects of his vigilance and activity. Sheep and cattle are his ſubjects. Theſe he conducts and protects with prudence and bravery, and never employs force againſt them, except for the preſervation of peace and good order. But, when in purſuit of his prey, he makes a complete diſplay of his courage and intelligence. In this ſituation, both his natural and acquired talents are exerted. As ſoon as the *horn* or the *voice* of the hunter is heard, the dog demonſtrates his joy by the moſt expreſſive emotions and *accents.* By his movements and *cries*, he announces his impatience for combat, and his paſſion for victory. Sometimes he moves ſilently along, reconnoitres the ground, and endeavours to diſcover and ſurpriſe the enemy. At other times, he traces the animals ſteps, and, by different modulations of *voice*, and by the movements, particularly of his tail, indicates the *diſtance*, the *ſpecies*, and even the *age* of the fugitive deer. All theſe movements and modifications of *voice* are perfectly underſtood by experienced hunters. When he wiſhes to get into an apartment, he comes to the door; but if that is ſhut, he ſcratches with his feet, makes a bewailing *noiſe*, and, if his petition is not ſoon anſwered, he barks with a peculiar and humble *tone*. The ſhepherd's dog not only underſtands the *language* of his maſter, but, when too diſtant to be *heard*, he knows how to act by ſignals made with the hand.

The ſenſes of the *fox* are equally good as thoſe of the *wolf*; but his ſentiments are more delicate, and the organs of his voice more pliant, which enable him to uſe a more extenſive *language*. The wolf utters only frightful howlings; but the fox barks in different tones, yelps, and raiſes a mournful cry ſomething reſembling that of the peacock. He varies his tones according to the different ſentiments with which he happens to be effected. He employs an *accent* peculiar to the chace, to the tone of deſire, of complaint, and of ſorrow. He has another *cry*, expreſſive of acute pain, which he utters only when he is ſhot, or has ſome of his limbs broken. His yelping is a ſpecies of barking, and conſiſts of a quick ſucceſſion of tones; at the termination of which he generally raiſes his voice ſimilar to the cry of the peacock.

The language of the *cat* is more limited than that of the dog. Still, however, it is highly expreſſive of her feelings and deſires.

When ſhe wants to flatter, or to ſollicit favour, ſhe makes a *purring* noiſe, accompanied with blandiſhing movements, and often rubs her ſides upon the ſhins or garments of the perſon from whom ſhe expects gratification. In the ſeaſon of love, the female not only goes in queſt of the male, but announces, by loud *cries* and diſguſting motions, the preſſure of her neceſſities. Theſe *cries* never fail to excite the ſentiments and procure the attention and aſſiſtance of the male. When a cat happens to be barred out, her *mew* of anxiety, or her petition to get admittance, is perfectly different from moſt of her other cries, but ſeems to be the ſame with that which ſhe utters when deſirous of food.

The *roe-buck* bellows not ſo frequently, nor with ſo loud or ſo ſtrong a voice, as the ſtag. The young ones utter a ſhort and plaintive cry, *mi...mi*, by which they indicate their want of food. This ſound is eaſily imitated; and the mother, deceived by the well-known *call*, often comes up to the very muzzle of the hunter's gun, and falls a victim to her maternal affection.

With regard to the *orang-outang*, the various ſpecies of *apes* and *monkeys*, their conformation gives many of them a near reſemblance in external figure to that of man. From this circumſtance, they are enabled to imitate almoſt every human action. LINNÆUS, and ſome other authors, have even gone the length of affirming, that the orang-outang *ſpeaks* with a kind of hiſſing voice. But we have no proper evidence of this ſuppoſed fact. On the contrary, the COUNT DE BUFFON, who often examined the ſmaller ſpecies of orang-outang, denies that this animal ever uttered any ſounds which had the moſt diſtant reſemblance to articulate language. By the mode of chattering and other ſounds, however, any perſon may ſoon learn their particular intentions and emotions. BATTEL, who deſcribes the largeſt ſpecies of orang-outangs, tells us, that 'they cannot *ſpeak*, 'and have no underſtanding more than a beaſt *.' By *ſpeech*, in this paſſage, BATTEL evidently means *articulate* language; and this very circumſtance is, perhaps, more than figure and manners, the ſtrongeſt characteriſtic which diſtinguiſhes mankind from the brute creation. The COUNT DE BUFFON has collected, from the moſt authentic travellers, a great number of facts concerning the general manners and ſagacity of the two ſpecies of orang-outangs; but, it ſhould appear, he has not been able to obtain much information as to their language, or modes of expreſſing their paſſions and ſentiments. Notwithſtanding the great ſimilarity between the form and organization, both external and internal, of the orang-outang, and the general ſtructure of man, yet he cannot lay claim to humanity. Though he has the ſame organs of *ſpeech*, he never attempts to *articulate*. The figure and proportions of his brain are likewiſe the ſame; but he diſcovers no extent of thought. There cannot, M. DE BUFFON properly remarks, be a more evident proof than is exhibited in the orang-outang, that matter alone, though perfectly organized, can produce neither language nor extenſive thinking, unleſs it be animated by minds ſuperior to thoſe of brutes.

The *pigmies* are very numerous in the mountains of Mauritania, Conſtantia, and Bugia. We are informed by MARMOL, that they live upon herbs, corn, and fruits; that, in their depredatory expeditions, they go in troops to rob the gardens or fields; but, before leaving the woods or thickets, one of them aſcends a high tree, or ſome eminence, from which he takes a ſurvey of the country, and, when he obſerves no perſon in the way, he gives the ſignal, by a *cry*, which is perfectly underſtood, that the troop may proceed with ſafety, and leaves not his ſtation as long as his companions are foraging abroad. But, whenever he perceives any perſon approaching, he *ſcreams*, with a loud and intelligible *voice*, warning the robbers of their danger, when the whole, by leaping from tree to tree, fly off, and make their eſcape to the mountains.

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* Purchas's Pilgrims, part 2. p. 982.

In Senegal, many other ſpecies of apes, baboons, and monkeys, when robbing orchards or corn-fields, obſerve a ſimilar conduct with that of the pigmies. One of them, on theſe occaſions, ſtands ſentinel on a tree, liſtening and looking about on all ſides, while the others are buſy in collecting the booty. When the ſentinel deſcries any perſon, he inſtantly, by loud and ſignificant *ſhrieks*, alarms the foraging troop, who obey the ſignal, and fly off with their prey *.

The *ouarines*, a large ſpecies of American monkeys, are diſtinguiſhed by the appellation of *preachers*. MARCGRAVE, in his Hiſtory of Braſil, relates the following facts concerning theſe preacher-monkeys, which, he aſſures us, he himſelf often witneſſed. The facts are, That, every morning and evening, the ouarines aſſemble in the woods; that one of them aſſumes a more elevated ſtation, and makes a ſignal with his hand for the others to ſit around and liſten to him; that, when they are all ſeated, he begins a *diſcourſe* ſo loud and rapid as to be heard at a great diſtance; that all the reſt keep the moſt profound ſilence; that, when he ſtops, he gives a ſignal with his hand for the others to reply; that, in an inſtant, the whole *cry* together, till he commands ſilence by another ſignal, which they, in a moment, obey; that the firſt reſumes his *harangue*; and that, after hearing him attentively for a conſiderable time, the aſſembly

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* Voyage de le Maire, p. 103.

breaks up *. It were to be wiſhed that MARCGRAVE had endeavoured to diſcover the intention of theſe *field-preachings*; for, if the circumſtances he relates be true, and I know no objection to his veracity, it is evident that the animals muſt be actuated by ſome peculiar motives. Theſe *harangues*, perhaps, may, like our houſes of Parliament, have ſome common intereſt for their object, and contain directions for the moſt prudent modes of accompliſhing their purpoſes.

We ſhall now leave the language of *quadrupeds*, and proceed to mention a few particulars concerning that of *birds*. Brevity here is the more neceſſary, becauſe in many places of my former volume, though treating of very different ſubjects, inſtances of the language of brute animals not unfrequently occur. Here I ſhall not confine myſelf to any ſyſtematic arrangement, but content myſelf with rambling, without any limited order, through the eloquence of the feathered tribes.

In general, it may be remarked, that every ſpecies of birds have peculiar modulations of voice expreſſive of love, of pain, of anxiety, of anger, of complacency, and of good or bad fortune. Theſe expreſſions, however, ſeem to be confined and intelligible to the individuals only of the ſame ſpecies. But there are certain ſounds, particularly thoſe of danger and of terror, which are perfectly underſtood, not only by the ſame ſpecies, but even by different genera and orders of birds. When the fox wiſhes to ſurpriſe birds in the neighbourhood of hedges, bruſh-wood, or trees, he lies down on his belly, and extends his hind-legs as if he were dead. In this ſituation, however, he is perfectly vigilant, and cunningly obſerves the motions of the birds along the hedges and trees. If any of them happen to ſpy him, they immediately ſend forth ſoft, mournful, but ſhrill *cries*, to alarm their neighbours, and to advertiſe them of the enemy's approach. Blackbirds and jays have been frequently obſerved to follow the fox, flying from tree to tree, and often repeating the ſame *cries* of alarm and of danger. Theſe *cries*, by whatever birds they are uttered, are underſtood by every ſpecies within reach of hearing, who inſtantly uſe all their arts of defence againſt the common enemy. Birds are well acquainted with their natural enemies, and this knowledge ſeems to be purely inſtinctive, and not derived from experience or obſervation. When they obſerve the *pine-weaſel*, though for the firſt time, they utter the ſame mournful *cry* to announce his approach, as when they ſee a fox. It is likewiſe worthy of remark, that birds utter this peculiar *cry* upon the appearance of all carnivorous animals, as the wolf, the fox, the pine-weaſel, the cat, &c.; but never againſt the ſtag, the roe, the hare, nor, I believe, even man, who, of all animals, is the greateſt deſtroyer of the inferior tribes.

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* Marcgrav. Hiſt. Braſ. p. 226.

The language of moſt birds is a muſical language, and reducible by a pitch-pipe to a muſical key. All ſpecies are not equally eloquent. The language of ſome ſpecies is copious and fluent, but that of others is confined to a few important ſounds, which are neceſſary to expreſs barely their feelings and their wants. But no bird, like the finny tribes, is perfectly mute. The language of birds, Mr WHITE of Selbourne remarks, is very antient, and, like other antient languages, very elliptical. They ſay little, but much is meant and underſtood*. *Owls* have a very expreſſive language.

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* See Nat. Hiſt. of Selbourne, by the ingenious and Rev. Mr WHITE, p. 240. of whoſe obſervations I have made frequent uſe.

They *hoot* in a fine vocal ſound, which has a conſiderable reſemblance to the human voice. This note ſeems to expreſs complacency, and ſometimes rivalſhip among the males. They likewiſe uſe a quick call, and an horrible ſcream; and they *ſnore* and *hiſs* when they mean to threaten and intimidate. The notes of the *eagle-kind* are ſhrill and piercing; and, in the ſeaſon of love, very much diverſified. *Ravens*, beſide their loud croaks, ſometimes exert a deep and ſolemn note, which makes the woods reſound. The amorous ſound of a *crow* is ſtrange, and even ſomewhat ridiculous. In the breading ſeaſon, *rooks* make clumſy attempts towards ſinging. The *parrot-kind*, as remarked in Vol. I. poſſeſs a great range of modulation in their voice, as appears by the facility with which they learn to pronounce words, and even ſhort ſentences. The *coo* of the pigeon is amorous and mournful. When the male makes love, or is jealous of rivals, he erects his body, raiſes the feathers of his neck and head, and employs many ſtrutting and lively geſticulations. To theſe movements he adds a *guttural*, but not unpleaſant kind of *ſpeech*, which is ſoft and alluring when he means to ſolicit the female. When jealous of a rival, he utters the ſame notes, but gives them a more ſharp, and even a menacing *tone*. The *woodpecker*, when pleaſed, ſets up a loud and hearty ſpecies of *laugh*. The *goat-ſucker*, or *fern-owl*, from the duſk till day-break, ſerenades his mate with *ſounds* ſimilar to the clattering of caſtanets. Moſt of the ſmall birds, or *paſſeres*, expreſs their complacency by ſweet modulations, and a variety of melodious *ſounds*. The *ſwallow*, by a *ſhrill alarm*, rouſes the attention of his ſpecies, and tells them that the hawk approaches. Gregarious and aquatic birds, eſpecially thoſe of the nocturnal kind, who ſhift their abodes in the dark, are extremely noiſy and *loquacious*; as cranes, wild-geeſe, wild-ducks, &c.

Their perpetual clamour prevents them from diſperſing and loſing their companions.

We ſhall now make a few obſervations on domeſtic fowls, whoſe *language* is beſt known, and, of courſe, beſt underſtood. The *voice* of the peacock, like thoſe of many birds of the fineſt plumage, is harſh and grating. The braying of aſſes, or the yelling of cats, are not more diſagreeable. The voice of the *gooſe* clanks and ſounds ſomewhat like a trumpet; but, the *gander*, eſpecially when he apprehends danger to the young brood, joined to his threatening aſpect, and the movements of his neck, *hiſſes* in a manner ſo formidable as deters the too near approach of children and of ſmall dogs. In the *duck-kind*, the *voices* of the female and male are remarkably different. The *quack* of the female is loud and ſonorous; but the voice of the *drake* is harſh, inward, and feeble. The cock *turkey*, when proud, or when addreſſing his miſtreſs, blows up his wattles, erects his feathers, makes a humming noiſe by vibrating his wings, and utters a gobbling kind of *ſound*, which, though we cannot deſcribe, is perfectly underſtood by his own ſpecies. When attacked by a boy, or any other adverſary, he aſſumes a pert and petulant *tone*; and ſuch is the obſtinate courage he diſplays, that he will rather die than give up the conteſt. A hen *turkey*, when ſhe leads forth her young brood, watches them with the utmoſt anxiety. If a hawk, or any bird of prey, appear, though very high in the air, the careful and affectionate mother announces the enemy with a low inward kind of *moan*. If he makes a nearer approach, her *voice* becomes earneſt and alarming, and her *outcries* are redoubled both in loudneſs and frequency. The effects of this intereſting *eloquence* upon the young are aſtoniſhing. They underſtand the intimidating *language* of the mother, though they know not the immediate cauſe of the danger; but, by the intuitive knowledge of the meaning of what ſhe *ſays* to them, they inſtantly employ every artifice to conceal and protect themſelves from the impending danger. To accompliſh this purpoſe, they run under hedges, bruſh-wood, and even the leaves of cabbages, and of ſuch other plants as happen to be near them.

None of our domeſtic birds ſeem to poſſeſs ſuch a variety of *expreſſion*, and ſo copious a *language* as common poultry. A chicken of four or five days old, when held up to a window frequented by flies, immediately ſeizes its prey, and utters little *twitterings* of complacency; but, if a bee or a waſp is preſented to it, its *notes* inſtantly become *harſh*, and expreſſive of diſapprobation, and of a ſenſe of danger. When a hen is about to lay an egg, ſhe intimates her feelings by a joyous and ſoft *note:* But ſhe has no ſooner diſburdened herſelf, than ſhe ruſhes forth with a *clamorous* kind of joy, which the cock and the reſt of his miſtreſſes immediately adopt. This tumultous noiſe is not confined to the family, or rather ſeraglio, but is tranſmitted from yard to yard, and ſpreads to every homeſtead within hearing, till at laſt the whole village is in an uproar. When a hen has hatched a brood, a new and intereſting ſcene is exhibited. Her relation as a mother requires a new ſpecies of *language*. She then runs *clucking* and *ſcreaming* about, and ſeems to be agitated with the greateſt anxiety. When men or dogs ſuddenly approach her feeble brood, her courage and maternal care are aſtoniſhing. With loud *cries*, and rapid motions, ſhe aſſails the enemy; neither a man, nor a lion, in theſe circumſtances, are ſufficient to repreſs the courage of this unarmed bird. I have ſeen a hen, when attending her young, boldly attack, intimidate, and beat of a maſtiff. The *vocabulary* of the cock is likewiſe pretty extenſive; and his generoſity and gallantry are remarkable: When he diſcovers a quantity of food, inſtead of devouring it himſelf, he inſtantly *calls* to his concubines to partake of the repaſt; and, if he diſcerns a bird of prey, or any other alarming danger, with a warning *voice*, he deſires his family to be on their guard againſt the common enemy. The cock has alſo at command his *love ſpeeches*, and his *terms* of defiance. But his moſt peculiar *ſound* is his *crowing*, by which, in all ages, he has diſtinguiſhed himſelf as the countryman's clock, as the watchman who proclaims the diviſions of the night.

On the ſubject of our common poultry, I muſt not omit a curious fact recorded by that intelligent naturaliſt the Rev. Mr WHITE of Selbourne. A neighbouring gentleman had, one ſummer, loſt moſt of his chickens by the depredations of a ſparrow-hawk, that was in the practice of gliding down between a pile of faggots and the end of his houſe to the place where the hen-coops ſtood. The owner, exaſperated to ſee his flock daily diminiſhing, hung a ſetting-net between the houſe and the pile, into which the unwary robber daſhed, and was entangled. Reſentment ſuggeſted retaliation; he, therefore, clipped the wings of the hawk, cut off his talons, and, after fixing a cork on his bill, threw him down among the brood-hens. Imagination, Mr WHITE remarks, cannot paint the ſcene that enſued. The *expreſſions* excited by fear, anger, and reſentment, were ſtrange and intereſting. The enraged matrons upbraided, execrated, inſulted, and, at laſt, triumphed over the helpleſs victim; they never deſiſted from buffetting their adverſary till they had torn him in pieces [*].

With regard to *fiſhes*, they have been always conſidered as perfectly devoid of *language*. But, on this ſubject, it muſt be remarked, that the element in which they live, their natural timidity, the ſwiftneſs of their movements, and a thouſand other circumſtances, remove them from the accurate inſpection and inquiries of men. That they have the organs neceſſary for hearing, the juſtly celebrated Dr Monro, in his diſſertation on fiſhes, has demonſtrated in the moſt ſatisfactory manner. It is likewiſe well known, that water, which always contains a certain portion of air, is an excellent vehicle of *ſound*. It is, therefore, from theſe two facts, highly preſumable, that fiſhes have ſome mode of communicating their ſenſations and deſires to one another. To what purpoſe ſhould Nature have beſtowed upon ſuch a numerous claſs of animals, as that of fiſhes, organs exquiſitely adapted for hearing, unleſs to endow them with that faculty? And, if fiſhes hear, it may fairly be concluded, that they occaſionally utter *ſounds* which are intelligible to their companions. The ſtrong analogy derived from all terreſtrial animals is another argument in ſupport of this rational conjecture.

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[*] WHITE's Nat. Hiſt. of Selbourne, p. 243.

We ſhall now make a few obſervations concerning the *language* of *inſects*, particularly thoſe of the winged tribes. The *amours* of dragon-flies, of ſpiders, and of butterflies, furniſh many appearances which permit us not to doubt, that the males and females have a very *expreſſive* mode of conveying their ſentiments to each other. Their varied movements, their little alluring arts, are indications of that *language* which all ſentient beings poſſeſs in ſome degree, and the *ſigns* of which are ſeldom equivocal. We ſee the male ſolliciting, by his gambols, his careſſes, and his perſeverance, favours which the female affects, at firſt, to refuſe, with no other apparent intention than to excite and inflame the paſſion of the male.

The *graſshopper* furniſhes us with a remarkable inſtance of the *language* of inſects. The graſshopper is a ſpecies of *ventriloquiſt*. The organs of his voice, which are both curious and complicated, inſtead of his head, are placed in his *belly*. By this inſtrument, in the ſeaſon of love, he *chants*, or *chirps*, to the female, who ſeems to be pleaſed with his addreſſes, and, when diſpoſed, ſhe approaches him, being led, not by the eye, but by his *voice*. From a very general analogy, we are warranted to ſuppoſe that organs of *voice* imply the relative organs of *hearing*. Hence we may conclude, that the female graſshopper both hears and underſtands the *love-ſpeeches* of the male.

Thoſe inſects which are brought forth, and live in ſociety, who mutually aſſiſt each other in conſtructing works for the common good and accommodation, ſeem to have the greateſt need of an extenſive *language*. Being deſtined to form one large family, to give mutual aid and ſupport to each other in all their common wants and operations, a ſpecies of *language*, and that not very limited, ſeems to be abſolutely neceſſary to enable them to underſtand and to execute the different labours allotted to them with that regularity and harmony, which is ſo remarkable in the magnificent ſtructures erected by bees, waſps, and many other gregarious inſects. Bees, as well as flies of every kind, make a humming *noiſe* by the vibrations of their wings. But the noiſe of the bee, when flying home with its load, is very different, even to our comparatively blunt ears, from that which it utters after arriving at the hive, where it makes a peculiar *noiſe*, which is perfectly underſtood by the working bees, who inſtantly come and carry off this freſh ſupply of materials.

Common flies, and particularly the large fleſh-flies, make a ſoft *ſinging* kind of noiſe when flying about in tranquillity. But, when alarmed, or when entangled in the web of a ſpider, the *noiſe* of their wings intimates diſtreſs and terror. Inſtead of being ſoft and agreeable, it is then loud, quick, harſh, and interrupted, preciſely analogous to the language and cries of men and of the larger animals when placed in ſimilar circumſtances. In my former volume, when treating of *hearing*, I have rendered it more than probable, that the common houſe-fly is endowed with the faculty of hearing. Whenever we perceive, that effects and movements are uniformly produced by certain ſounds, it may be concluded, that the animal is furniſhed with organs of hearing, though, from their minuteneſs, we are unable to diſcover where they are ſituated. In the winged tribes of inſects, it is probable that the organs of hearing are placed near the inſertion of the wings, or, at leaſt, that nerves or veſſels proceed from the wings to the more immediate organs of hearing, which may be incloſed under that elaſtic cruſtaceous ſubſtance with which the head is covered. This idea will be rendered ſtill more probable by attending to the various modulations of *ſounds* produced by the vibrations of the wings, and by comparing theſe with the preſent ſituation and employment of the inſect. When a common fly is irritated or terrified, the *noiſe* made by the vibrations of its wings is very different from that produced when the animal is flying about undiſturbed. When a houſe or a fleſh-fly is tormented by thoughtleſs children, who, for amuſement, often inſert pretty large pins into the bodies of theſe inſects, which the animals, with much pain, are obliged to trail after them, the *noiſe* of their wings is then highly expreſſive of impatience and of torture. But, when they meet with food agreeable to their taſte, the *noiſe* of their wings is ſoft, gentle, and even melodious. When the ſeaſon of their amours arrives, a new and intereſting ſcene, both with regard to movements and *language*, is exhibited. At that important period of their exiſtence, they aſſemble in groups, which are more or leſs numerous, according to circumſtances. Theſe groups fly about, making a thouſand circumgyrations, but always keep pretty cloſe to each other. In theſe *love-dances*, as I call them, the males and females often meet, and lay hold of each other in the air; but the congreſs is only momentary. The *noiſe* of their wings, however, on this critical occaſion, is briſk, ſharp, and ſeemingly expreſſive of *joy:* This *noiſe* is eaſily diſtinguiſhable from that excited by terror or by any embarraſſing or painful ſituation. But theſe groups of lovers not unfrequently deſcend from the higher parts of a chamber, and alight upon tables or chairs. Here their *language* and motions become ſtill more intelligible. The males run about with ardour in queſt of the females, and perch with alacrity and a pleaſant murmuring ſpecies of *noiſe* upon the backs of the females, where, if their ſtay is ſhort, it is amply repaid by the frequency of reiteration. I have often been amuſed with their miſtakes. Though the eyes of flies conſiſt of numerous lenſes, ſo ſituated that they can ſee objects all around them; yet theſe lenſes are ſo minute and ſo convex, that they can perceive objects at ſmall diſtances only. When the males are roaming about in queſt of females, it not unfrequently happens, in the keenneſs of reſearch, that two males rencounter: As ſoon as the mutual miſtake is perceived, each makes a ſudden *ſnapping* kind of *noiſe*, as if they were ſpitting in one another's faces, and then run off in purſuit of more ſuitable mates.

Some ſpiders, when they wiſh to have ſenſual intercourſe, have a ſingular method of communicating their deſires. A ſpider, who wants a mate, has a mode of *ſtriking* againſt the wall or wood where ſhe has ſettled. She firſt gives nine or ten gentle blows, reſembling, but ſomewhat quicker and louder, the vibrations of a watch; after which, ſhe remains ſome time ſilent, as if waiting for a reſponſe; if ſhe receives none, ſhe repeats the ſame *ticking noiſe*, by what means it is not perfectly known, at intervals of about an hour or two, reſuming this exerciſe and reſting alternately both during the day and the night. After theſe amorous *ſollicitations* have been continued two or three days, if no lover makes his addreſſes, probably becauſe none are within the reach of hearing, ſhe changes her ſituation, till ſhe receives an anſwer from a neighbouring mate, who makes preciſely the ſame kind of *noiſe*. If they are mutually pleaſed with each other, the *converſation* becomes briſker, and the beatings more frequent, till, at laſt, the approach is ſo near, that the two *ſounds* are confounded. In a very ſhort time, a deep ſilence takes place, when it is reaſonably ſuppoſed that the intentions of Nature are accompliſhing *.

This chapter ſhall be concluded with a few general remarks. With regard to the *language* of beaſts, a few examples have been ſelected from the four great claſſes of Quadrupeds, Birds, Fiſhes, and Inſects. To have enumerated more, would not only have tired the reader, but led me far beyond my intended limits. From the few ſpecimens I have given, it is apparent, that Nature, in this, as well as in every other of her operations, ſupports and conducts her ſyſtem of animation by univerſal and intelligent laws. On man ſhe has beſtowed three ſpecies of language, namely, *natural* language, the language of *geſture*, and, what is ſtill ſuperior, the faculty of inventing and employing *artificial* language. But the moſt diſtinguiſhed of the brute animals are limited ſolely to the two former modes of communicating to each other their various feelings and deſires. The *language* of the inſect tribes ſeems to be ſtill more limited. Their *converſation* is chiefly carried on by various vibrations of their wings, and by ſimilar inſtruments; but ſtill theſe ſimple modes of expreſſion, by whatever motives they are produced, are perfectly underſtood, which is the ſole end and intention of all *language*.

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* Amuſement philoſophique ſur le language des Beſtes, par G. H. Boujeant, p. 118. Father Boujeant, as appears from his writings, was a man of conſiderable learning and ingenuity. He was alſo an acute obſerver of the operations and oeconomy of Nature. He ſupported his ideas, concerning the relative *underſtanding* and *language* of *beaſts*, with great ſpirit and ability. But fanatical, or, which is the ſame thing, ignorant individuals, and, at laſt, the *Romiſh church*, were alarmed. Boujeant was himſelf a Jeſuit; and, when called to account for his doctrine, like a gentleman of the profeſſion, in a ſecond edition, he not only *recanted* ſolemnly all his opinions on the ſubject, but acknowledged them to have been *deluſions of the Devil!* To augment this literary, or rather *religious* farce, the very ſame opinions and reaſonings are repeated in the ſubſequent edition, accompanied with the ſigned *recantation* of the author! The diffuſion of ſcience, ſo often attempted to be ſuffocated by *prieſts*, though, to the diſgrace of human nature, both an antient and a modern practice, exhibits a dreadful picture of what are called *the Lords of the Creation!*

One very ſingular obſervation remains to be made. Contrary to what almoſt univerſally takes place in the human ſpecies, the *females* of the inferior animals are not ſo *loquacious* as the *males*. This remarkable difference, if we ſcrutinize impartially the intentions of Nature, will be found, like all her other intentions, to be productive of the wiſeſt and moſt beneficent purpoſes. Among thoſe brute animals who *pair* or *marry* by mutual ſelection, and particularly almoſt the whole of the feathered tribes, when not corrupted by domeſtication, the *language* of the *males* is more extenſive and more frequently repeated, than that of the *females*. It is for this reaſon, that, in purchaſing ſinging birds, great attention is paid to thoſe characters which diſtinguiſh the *males* from the *females*, the latter being conſidered as comparatively *mute* and uſeleſs. When the female thruſh, or blackbird, is brooding over her eggs, the male ſits upon a neighbouring tree; and, when no danger appears, he tells her, in melodious and encouraging ſtrains, not to be afraid, becauſe he is keeping the ſtricteſt watch. But when he perceives the too near approach of man, of birds of prey, or of any other rapacious animals, he inſtantly changes his addreſſes to her. Inſtead of his former ſoothing notes, he flies from branch to branch, or from tree to tree, uttering diſmal, alarming, and harſh *cries*. In this manner he tells her to beware of the enemy. When the danger is greatly increaſed, by a ſtill nearer approach, the male again changes his *language*: He then, by quick and precipitate *ſounds*, commands her to *fly*, and to ſave herſelf even in preference to her eggs or her defenceleſs brood.

Here the intentions of Nature as well as the neceſſity of a varied though limited *language*, are evident both to our ears and eyes; for, on ſuch occaſions, the *ſounds* are uniformly accompanied with the moſt expreſſive *geſtures*. When boys are about to carry off a neſt of young birds, both parents, notwithſtanding their natural dread of man, which is too often augmented by cruelty, make a much nearer approach than at any other time. Their almoſt invincible attachment to their offſpring ſeems, in a great meaſure, to deprive them of the principle of ſelf-preſervation. Their *cries* are low, mournful, and not unfrequently reſemble thoſe uttered by human beings when placed in ſimilar circumſtances. But, when deſpair removes all hope, another change of *language* is exhibited. Both parents then fly round the aſſailant, ſcreaming and uttering threatening cries; and ſometimes they even attempt to repel the ſpoiler.

When a boy, I carried off a neſt of young ſparrows about a mile from my place of reſidence. After the neſt was completely removed, and while I was marching home with them in triumph, I perceived, with ſome degree of aſtoniſhment, both parents following me, at ſome diſtance, and obſerving my motions in perfect ſilence. A thought then ſtruck me, that they might follow me home, and feed the young according to their uſual manner. When juſt entering the door, I held up the neſt, and made the young utter the *cry* which is expreſſive of the deſire of food. I immediately put the neſt and the young in the corner of a wire-cage, and placed it on the outſide of a window. I choſe a ſituation in the room where I could perceive all that ſhould happen, without myſelf being ſeen. The young animals ſoon *cried* for food. In a ſhort time, both parents, who underſtood the language as well as the peculiar *voices* of their mutual offſpring, having their bills filled with ſmall caterpillars, reſorted to the cage, and after *chatting* a little, as we would do with a friend through the lattice of a priſon, gave a ſmall worm to each individual. This parental intercourſe continued regularly for ſome time, till the young were completely fledged, and had acquired a conſiderable degree of ſtrength. I then took one of the ſtrongeſt of them, and placed him on the outſide of the cage, in order to obſerve the conduct of the parents after one of their offſpring was emancipated. In a few minutes, both parents arrived, loaded, as uſual, with food. They no ſooner perceived that one of their children had eſcaped from priſon, than they fluttered about and made a thouſand *noiſy* demonſtrations of *joy* both with their wings and their *voices*. Theſe tumultuous *expreſſions* of unexpected happineſs at laſt gave place to a more calm and ſoothing *converſation*. By their *voices* and their *movements*, it was evident that they earneſtly entreated him to follow them, and to fly from his preſent dangerous ſtate. He ſeemed to be impatient to obey their mandates; but, by his *geſtures* and the feeble *ſounds* he uttered, he plainly told them that he was afraid to try an exertion he had never before attempted. They, however, inceſſantly repeated their *ſollicitations*; by flying alternately from the cage to a neighbouring chimney top, they endeavoured to ſhow him how eaſy the journey was to be accompliſhed. He at laſt committed himſelf to the air, and landed in ſafety. Upon his arrival another ſcene of clamorous and active joy was exhibited. Next day, I repeated the ſame experiment by expoſing another of the young on the top of the cage. I obſerved the ſame conduct with regard to the remainder of the brood, which conſiſted of four. I need hardly add, that not one, either of the parents or children, ever afterwards reviſited the execrated cage.

We have already ſeen, and every body knows, that in general, the *males* of the inferior animals are more *loquacious* than the *females*. But, in the human ſpecies, it is likewiſe an unqueſtionable fact, that the *females* are much more talkative than the *males*. It is even remarkable, that *female* children, though of the ſame family, and receiving the ſame inſtructions and example, acquire the faculty of *ſpeaking* one year, and ſometimes two, ſooner than the *males*.

We ſhall now endeavour to inveſtigate the intentions of Nature in creating ſuch a marked diſtinction.

In all ages, and in all regions of the earth, the early education and management of children have neceſſarily devolved upon the mothers. For this important taſk, they are much better qualified, both in the ſtructure of their bodies, and in the diſpoſitions of their minds, than the males. The connection between the mother and child begins long before it becomes an object of attention to the father. By a thouſand circumſtances, which mothers only know, and ſometimes attempt, though obſcurely, to deſcribe, they contract an affection for a ſtill inviſible being. After the child is uſhered into the world, the curioſity and the ſympathetic joy of the father, are excited. He, accordingly, exerts himſelf to render the condition both of the mother and child as happy as poſſible. To ſupport the child with a mild but nutritive food ſecreted from the blood and other juices of the mother, Nature has provided her with a wonderfully complicated ſyſtem of veſſels, or lacteal pipes, which all terminate in the nipples of her breaſts. To theſe nipples the infants inſtinctively apply their mouths, and, by ſuction, create a vacuum. The preſſure of the external air upon the breaſt, or collection of tubes filled with milk, forces them to diſcharge their contents into the mouth of the child, who continues to ſwallow it till its ſtomach is ſatisfied. During this tender and precarious ſtate of exiſtence, the anxious and perſevering attention of the mother, makes her chearfully endure many toils and hardſhips, under which ſhe would often ſink, were ſhe not, on ſuch occaſions, almoſt preternaturally ſupported by mere ſtrength of affection.

After the child has arrived at the age of two or three months, and, in ſtrong and healthy children, much earlier, or as ſoon as it is capable of giving a tranſient attention to particular objects, then the exertions of the mother are almoſt perpetual. Her ſole object is to pleaſe by little amuſements which ſhe endeavours to accommodate to the weak, but gradually augmenting capacity of the infant. The chief inſtruments which ſhe addreſſes are the *eyes* and *ears.* To the *eye* ſhe preſents ſhining or luminous objects with which children are very early delighted ; and, at the ſame time, repeatedly mentions the *names* of the particular objects. Thus, by habit, the *natural volubility* of female tongues is greatly improved. I have often been amazed at the dexterity and quickneſs of mothers and nurſes when endeavouring to pleaſe fretful children. They hurry the child from object to object, in order to diſcover if any of them arreſts its *eye*. If this attempt does not ſucceed, they have recourſe to other expedients. The *ears* of all infants are delighted with any loud *noiſe*. The mother, who wiſhes to appeaſe the fretfulneſs, or even to keep up the ſpirit and chearfulneſs of the child, toſſes it about in her arms, ſings, and talks alternately; and, on ſuch occaſions, it is aſtoniſhing to obſerve the quickneſs of her tranſitions from one ſpecies of incomprehenſible jargon to another. Still, however, ſhe goes on either *rattling* with her *tongue*, or making a *rattling noiſe* on tables, chairs, &c. A perſon who had never attended to theſe ſcenes, which are ſo often exhibited by a ſprightly mother and a ſprightly child, would be apt to conclude, that both were proper inmates for a bedlam. Theſe are well known to be univerſal facts; and we ſhall now endeavour to ſhow their utility.

It is a very antient adage, that Nature does nothing in vain. To women ſhe has given the talent of talking more frequently, as well as more fluently, than men: She has likewiſe endowed them with a greater quantity of animation, or what is commonly called *animal ſpirits*. Why, it may be aſked, has Nature, in this article, ſo eminently diſtinguiſhed women from men? For the beſt and wiſeſt of purpoſes. The principal deſtination of all women is to be mothers. Hence ſome qualities peculiar to ſuch a deſtination muſt neceſſarily have been beſtowed upon them. Theſe qualities are numerous: A ſuperiour degree of patience, of affection, of minute, but uſeful attentions, joined to a facility of almoſt inceſſant *ſpeaking*.

Here, however, I muſt confine my obſervations to the laſt conſpicuous and eminent accompliſhment. To be occupied with laborious offices, which demand either bodily or mental exertions, and not unfrequently both, is allotted to the men. Theſe cauſes, beſide their comparative natural taciturnity, totally incapacitates them for that loquacity which is requiſite for amuſing and teaching young children to *ſpeak*. But the employments of women are of a more domeſtic kind. Houſehold affairs, and particularly the nurſing and training of children, are fully ſufficient to engroſs their attention, and to call forth all their ingenuity and active powers. The *loquacity* of women is too often conſidered, by poets, hiſtorians, and by unthinking men, as a reproach upon the ſex. Men of this deſcription know not what they ſay. When they blame women for *ſpeaking much*, they blame Nature for one of her wiſeſt inſtitutions. Women *ſpeak much*. They ought to *ſpeak much*. Nature compels them to *ſpeak much*; and, when they do ſo, they are complying religiouſly with one of her moſt ſacred and uſeful laws. It may be ſaid, that *ſome men* talk as *much* as women. Granted. But beings of this kind, I deny to be *men*. Nature ſeems to have originally meant them to be *women*; but, by ſome croſs-accident, as happens in the production of *monſters*, the external *male form* has been ſuperinduced upon a *female ſtock*.

CHAPTER VIII.

Some Remarks on the Comparative Pleaſures and Sufferings of Animals.

THERE are two great ſources of animal pleaſure and pain. The one ariſes from *mental*, and the other from *corporeal* cauſes. In proportion to the extent of intellectual powers in animals, the variety and the intenſeneſs of their pleaſures muſt be augmented. I wiſh the reverſe were not equally true. Man, who ſtands at the head of all the animated beings of which we have any knowledge, derives the moſt extenſive, variegated, and delicate ſpecies of pleaſure from natural genius, eſpecially when improved and illuminated by ſcience, by literature, and by impartial, but acute obſervation. The means, however, of acquiring theſe accompliſhments, are often productive of the greateſt human *calamities*. They cannot be attained without much ſtudy and reading. But ſtudy and reading imply a ſedentary life; and a ſedentary life gives riſe to conſumptions, to the ſtone, to the gout, to want of appetite, and, of courſe, to every evil which hell can invent, or poor mortals ſuffer.

But let us take a view of the enjoyments procured by the acquiſition of knowledge, and by a proper culture of the mind. Every ſtep we advance, from the very commencement of our progreſs, affords pleaſures which are totally unknown, and even incomprehenſible to the ignorant and too commonly vicious part of mankind, which unfortunately includes much more than nine-tenths of the ſpecies.

When about five or ſix years of age, our ſole delight conſiſts of rambling about, flying from one external object to another with often an unmeaning rapidity, and without perceiving, that, by this reſtleſs activity, we are laying up ample ſtores for future reflection. Nature, in her operations, has ſeldom one intention only in view: While ſhe is thus early ſtimulating us to gratify curioſity, or, in other words, to enjoy pleaſures which are perpetually changing their forms and modes of impreſſion upon the ſoft and ductile mind, ſhe is, at the ſame time, extending and ſtrengthening the body by the movements which theſe exertions neceſſarily require. The pleaſures reſulting from the acquiſition of ideas by the inſpection and examination of new external objects, from the age mentioned above, proceed with amazing rapidity. But, after this period, in what are called *civilized*, or rather *artificial* ſocieties, the natural current of the mind is checked, and turned into very different channels. To read, to write, to acquire *dead* or *foreign languages*; and, if the deſtination be ſtill higher, geometry, and ſpeculative knowledge of every ſpecies, are made the principal objects of a young man's attention. This ſevere check is, in general, too early given. At the very time when young minds are eagerly inveſtigating even the *minutiæ* of Nature, as inſects, reptiles, and, when a little farther advanced, birds and quadrupeds of different ſpecies, they are prematurely hurried on, to the moſt abſurd and prepoſterous of all ſtudies, namely, that of *dead* and *foreign languages*, long before they underſtand, to any extent, their *native tongue*.

Some ſmall portions of the antient *hiſtorical* compoſitions may ſometimes be partially underſtood, and even reliſhed by ſchool-boys. But what are the ſentiments which ſtrike in the moſt forcible manner the unſuſpicious, and, as yet, uninformed minds. They are of the moſt diabolical kind. *Animoſity*, *battles*, *treachery*, *cruelty*, and *murders!* The ſucceſsful perpetrators of theſe horrid crimes are celebrated, both by their own *hiſtorians*, and by unthinking *pedagogues*, under the grand appellation of HEROES! What was the renowned *Alexander?* A *great Hero?* And what is a *great Hero?* An unrelenting *butcher* of his own *ſpecies*! Such was ALEXANDER, ſuch was CÆSAR, and ſuch were all *the ſimilar vagabonds*, *thieves*, and *murderers* of antiquity. Theſe men, however, are exhibited by our *teachers*, as glorious examples of human *virtues!* What monſtrous *leſſons* to young and tender minds! But, if our *teachers* were wiſer than they generally are, the hiſtorical compoſitions of the antients would afford them the fineſt topics for inculcating every ſpecies of moral duty, and of moral feeling, upon the minds of youth. Patriotiſm, love of liberty, and bravery in the defence of the natural rights of man, when tempered with moderation and humanity, and, if properly explained, enforced, and illuſtrated by the numerous and ſplendid characters which antiquity occaſionally affords, would not only excite attention, but expand the mind, and give it virtuous impreſſions which no time could ever efface.

I mean not to depreciate *claſſical learning*. I only complain of a moſt abſurd and hurtful mode of education, which is, it may be ſaid, *univerſal* in Scotland. Not to mention the *maſters* of different mechanical employments, *JOURNEYMEN ſhoemakers*, *taylors*, *weavers*, *carpenters*, *bakers*, *maſons*, *bricklayers*, &c. uniformly ſend their children, when at the age of ſeven or nine, for the ſpace of four or five years to learn *Latin* at *grammar* ſchools! During this time, the poor boys are forced to attend the ſchool, and not unfrequently whipped into the repetition of ſome *Latin vocables*, which are never to be of any uſe to them during life. For, after performing this, to them, uſeleſs, painful, and dreary taſk, the thread is inſtantly cut, and they are hurried into apprenticeſhips, and, of courſe, into the buſineſs of life, without underſtanding either their *own*, or any other *language*. The progreſs of Nature may, it is true, be ſometimes checked, but never entirely ſtopped. During the hours of receſs from ſcholaſtic diſcipline, ſhe reſumes her empire, and by her irreſiſtible power, obliges the children to friſk and romp about, and to enjoy thoſe various and pure pleaſures which reſult from activity and amuſement. But, theſe enjoyments are no ſooner over, than the abhorred ideas of unnatural confinement, and of a conſtrained attention to *jargon*, which, to them, is completely unintelligible, inſtantly recur, and harraſs and terrify their imaginations.

I have hitherto limited my remarks to *languages* alone. But, with regard to ſentiment, the motely *chaos* becomes doubly *dark*. Of battering rams, ſpears, ſwords, ſhields, and other warlike inſtruments, ſome idea may be formed. But the political views of commanders, the various marches and counter marches of armies, of detached parties for the purpoſes of foraging, or of obſerving the motions and probable intentions of the enemy, and the means employed to render theſe intentions abortive, muſt be perfectly incomprehenſible to ſchool-boys, who do not know one inch of the countries where ſuch operations are tranſacting. It will be ſaid, perhaps, that all theſe difficulties may be obviated by proper *maps* and deſcriptions. To young men farther advanced in years, and who are deſtined to ſome learned profeſſion, or to the education which every gentleman ought to receive, *maps* and deſcriptions are excellent ſources of information. But, to ſchool-boys, at the age I ſpeak of, *maps* and deſcriptions convey no ideas of the countries they are intended to repreſent. *Globes*, it may be thought, will remove all objections of this kind. *Globes*, however, only augment the obſcurities ariſing from *maps*, when attempted to be thus prematurely obtruded upon minds totally incapable of underſtanding the principles upon which either of them are conſtructed. The names of countries, of ſome rivers, and chief towns, like *Latin vocables*, may, by the mere exertions of memory, and of perſeverance, be mandated, and repeated, as the words and ſhort ſentences which *parrots* are taught to expreſs. But, by theſe exerciſes, no new ideas are acquired; nor are thoſe which may have formerly been in ſome meaſure acquired, either illuſtrated or expanded. The *fruitleſs* and *painful* labours, however, which ſuch prepoſterous conduct in managing the early education of youth produce, are immenſe, and truly ridiculous.

Theſe and ſimilar obſervations relate principally to *proſe* compoſitions. But, what are we to ſay of *poetry*, the language of which is highly *figurative*, and the *ſentiments* and alluſions are derived from every object of nature and of art, which can ſtrike the imagination of the poet? To read ſuch works of genius and of learning with any degree of intelligence, often baffles the experience, the induſtry, and the abilities of our moſt acute commentators. This remark is appli-

cable,

cable, in part, to every ſpecies of poetry, but acquires a redoubled force with regard to that ſpecies called *epic*. Beſide the various deſcriptions and alluſions derived from natural and artificial objects, what goes under the ſtrange appellation of *machinery*, is almoſt perpetually introduced. Not contented with *heroes* and brave *men*, in deſcribing battles and human exertions, *gods* or *devils* muſt interfere in every hoſtile conteſt. In the Heathen mythology, the number of gods and goddeſſes is as infinite as their attributes and deſtinations. Every nation, every town, every mountain, every river, and many principal families, and even individuals, were ſuppoſed to be the favourites of particular divinities, by whom they were ſuperintended, and protected, on all critical emergencies, from danger and death. When two heroes met and commenced a furious combat, if one of them was about to fall, to prevent the deadly blow, a *god* or *goddeſs* inſtantly ſtept forward to his aſſiſtance, and, by ſome ſilly or abſurd miracle, ſaved him from impending deſtruction! BUTLER, that prince of humour and of wit, ridicules, in the fineſt ſtrains, the *machinery* employed by ancient as well as modern poets. When two of his renowned heroes were about to engage, not with ſwords, but with fire-arms, in the moment of danger, he makes PALLAS interpoſe to ſave her favourite, in the following ludicrous manner:

> But PALLAS came in ſhape of *ruſt*,
> And 'twixt the ſpring and hammer thruſt
> Her *Gorgon* ſhield, which made the *cock*
> Stand *ſtiff*, as 'twere transformed to *ſtock* *.

The ſplendid and beautiful deſcriptions of many natural objects are not more intelligible to mere boys than the machinery of *gods*, of *goddeſſes*, of *angels*, or of *devils*. *Amaranthine* bowers, *myrtle* groves, tombs covered with the diſmal *cypreſs*, crowns of *laurel*, the deadly *nightſhade*, the *cedar* of Lebanon, and a thouſand ſimilar names of objects, are equally unknown to the *maſter*, to the *ſchool-boy*, and often to the very *poets* who uſe them in their compoſitions. When the names and deſcriptions of plants happen to occur in the reading either of proſe or verſe, it would be no difficult taſk, particularly in the ſeminaries of Edinburgh, where we have one of the moſt extenſive and beſt repleniſhed *botanic* gardens in Britain, for *maſters* to procure *ſpecimens* of almoſt every vegetable that is mentioned by the hiſtorians and poets of antiquity. A ſingle inſpection of ſuch ſpecimens would elucidate many paſſages in claſſical authors more completely than all the definitions which human ingenuity can invent. Beſides, this mode of explaining particular parts of the Claſſics would have another happy effect. It would not only give immediate pleaſure to boys, but create a habit of attention to the productions of Nature with which we are perpetually ſurrounded, and perpetually overlook.

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* Hudibras, canto 2. line 781.

But, ſay our *pedagogues*, for an explanation of all ſuch generic or ſpecific *names*, conſult your *dictionary*. We ſhall do ſo; and take a few examples from that of *Ainſworth*. AMARANTHUS, *everlaſting, a flower which never fadeth!* CUPRESSUS, *a cypreſs-tree!* MYRTUS, *a myrtle-tree!* LAURUS, *the laurel or bay-tree!* CIRCÆA, *the herb called night-ſhade!* MORUS, *a mulberry-tree!* MERCURIALIS, *the herb called Mercury!* MESPILUS, *a medlar-tree!* MANDRAGORAS, *an herb called mandrake!* MENTHA, *the herb called mint!* AMYGDALA, *an almond-tree!* PLANTAGO, *plantain!* LEUCOGRAPHIS, *an herb good for thoſe who ſpit blood!* I will not diſturb my readers with more ſpecimens of ſimilar unmeaning *explanations*, or rather no *explanation* at all; for they convey no ideas whatever. In almoſt every page of our common dictionaries, whether Latin, Engliſh, French, &c. examples of ſuch *jargon* are to be found. Our Lexicographers, however, not unfrequently deſcend ſtill lower, and, inſtead of abſurd definitions, or ſubſtituting Engliſh for Latin names, in which they are likewiſe *often* wrong, content themſelves with barely ſaying, the *name* of a *tree!* the *name* of a *plant!* the *name* of an *herb!* the *name* of a *precious ſtone!* the name of a *four-footed beaſt!* *&c.*

Are theſe the ſources from which *boys*, or even *men*, are to derive information concerning the productions of Nature? But, it is much to be lamented, that, in general, our *pedagogues* themſelves are unqualified to uſe the proper reſources, and, conſequently, muſt be equally ignorant as the pupils they are attempting to inſtruct. To boys the taſk of learning dead languages is ſufficiently hard and laborious. But, when ordered to read paſſages where natural objects of various kinds frequently occur, in the explication of which neither their *dictionaries* nor their *maſters* can afford the ſmalleſt aſſiſtance, the *drudgery* of groping in the *dark* becomes often ſo *painful*, that many boys leave the ſchool perfectly *diſguſted*, and drop for-ever ſuch unprofitable, and, to them, unintelligible ſtudies.

But, notwithſtanding theſe, in particular inſtances, perhaps unavoidable *difficulties*, when ſomewhat farther advanced in years, if young men, by perſevering induſtry, joined to a partial knowledge of ſome branches of ſcience, are once enabled to read and to reliſh the writings of ancient or of foreign authors, then the *pleaſures* reſulting from the peruſal of them more than counterbalance the *pains* ſuffered in the acquiſition of that ſpecies of knowledge. Some of the above remarks are equally applicable to the ſtudy of ſcience and of art. But, as the principles of the arts and ſciences are fixed, and ſeldom ſubject to cavil or miſrepreſentation, whenever theſe ſimple and natural principles are properly explained and underſtood, the *pleaſures* ariſing from their application are very great. As formerly remarked, premature *ſtudies* are uniformly *painful*; becauſe ſuch young minds are incapable of comprehending the principles, and far leſs the application of them to arts or ſcience. *Grammar*, the firſt ſcience obtruded upon, I may ſay, *infantine* intellects, is one of the moſt abſtract and intricate. To attain even a tolerable knowledge of grammar, whatever be the language, (for the general principles are, and muſt be the ſame,) preſuppoſes a conſiderable range of intuitive facts, as well as of acquired ideas.

When theſe difficulties, however, are once ſurmounted, and the mind is enabled to perceive the beauties and the utility of ſcience, its *happineſs*, which it hourly receives from a thouſand ſources, may be ſaid, as far as our preſent condition admits, to be complete. But a mind thus cultivated is by no means *ſatisfied*. Every new acquiſition, though attended with *pleaſure*, produces, at the ſame time, a number of *painful* ſenſations. In proportion as the mind is expanded by different kinds of ſcience, its deſire for farther and often impoſſible acquiſitions augments, and gives riſe to *painful* anxieties, which not unfrequently terminate in *dejection*, which is a ſpecies of *madneſs*.

We ſhall now trace the progreſs and feelings of a well informed mind, after it has engaged in the more ſerious and intereſting affairs of ſociety. Here a preliminary remark muſt be made. The more the mind has been ſtored with a variety of knowledge, the more *acute* are its *feelings*. It derives *pleaſure* from many ſources, of which the *vulgar* can have no idea. But, mark the reverſe. The cauſes of *pain* augment in more than a quadruple proportion. Of moſt of theſe the *vulgar* have not a conception; but they *torture* the feelings of what are called *refined minds*.

Buſineſs, of one kind or another, now becomes neceſſary; and an almoſt infinite ſeries of *pains* and of *pleaſures* are the unavoidable reſults. Mental or corporeal exertions, however laborious, we ſhall not conſider as abſolutely *painful;* for when theſe are paſt, and followed with ſucceſs, they are cauſes of the greateſt *pleaſures*. At this period of life, another ſource of *pleaſure*, as well as of *pain*, ariſes in an unexpected, and often involuntary manner. Both in the male and female ſex, peculiar and ſtrong attachments are formed. Marriage, in general, is the conſequence of ſuch attachments: But, with regard to the preſent ſubject, what are the common conſequences of marriage? *Children*, and a multitude of new *pleaſures* and *pains*. When in health, the *pleaſures* afforded by children are numerous and delightful; but, when *diſeaſe* comes, the account is more than balanced. A helpleſs infant tortured with *pain* is a moſt *excruciating* object. But, when a lovely child is, perhaps, ſuddenly torn from its mother's breaſt by *death*, the *painful* ſenſations excited by ſuch an event, *parents* alone can know. To proceed: When children have happily got over the common diſeaſes incident to that critical period of life, and have advanced to manhood, and engaged in different occupations, the *anxieties* of parents, inſtead of being *blunted*, become more *acute*. They then look forward, with redoubled *apprehenſion* and *affection*, to the probable ſucceſs or misfortunes of their offspring. When ſucceſsful, the *pleaſure* is great. But when, from negligence and vice, or even from unforeſeen misfortune,

tune, a contrary event takes place, the *painful* feelings of parents are not to be deſcribed. Parents not unfrequently, from a natural, but ſuperabundant affection, riſk more than their fortune with a view to bring their children reſpectably forward in the world, and to render them happy. Such conduct is fooliſh; but the folly is amiable. A ſingle ſlip, however, in children too frequently produces the greateſt *miſery* to both them and their parents. In all ſuch caſes, contrary to the common adage, *evil comes out of good.*

We have hitherto given ſlight ſketches of the *pains* and *pleaſures* ariſing from highly *cultivated* minds; and ſhall now deſcend to what are called the *vulgar* and uninformed.

The *vulgar*, in all nations and conditions of ſociety, conſtitute the great body of the human race. Born and brought up by poor and ignorant parents, their children, of neceſſity, are excluded from every ſource of ſuperior knowledge. Theſe ſeemingly unfortunate circumſtances, it ſhould appear, would be productive of the greateſt *miſery*. But Nature, ever attentive to the general *happineſs* of her productions, has decreed that the *vulgar* ſhould, at leaſt, be as *happy* as the *learned.* They are excluded from many ſources of real *pleaſure* which the learned poſſeſs. But they know nothing of ſuch defects; and what they do not know cannot poſſibly give them *uneaſineſs.* They labour with chearfulneſs, and eat their food with an appetite which no riches can purchaſe. Every moderate animal *enjoyment* is within their reach; and their rank in ſociety precludes them from many *painful* circumſtances which opulence alone can procure. Their ſleep is ſound and refreſhing; and, as their food is generally light and eaſily digeſted, they are ſeldom troubled with thoſe *diſagreeable dreams* which *torment* the luxurious, whoſe ſtomachs are not only feeble, but often overloaded with *dainties*, and ſtill oftener with *intoxicatiug liquors*. The vulgar are not *harraſſed* with ambition, nor anxiouſly ſolicitous concerning *future* proſpects or *future* events. They *enjoy* the preſent moments as they fly, and *rely* upon the continuance of ſimilar ſources of happineſs.

In their domeſtic affairs, the *vulgar* are exempted from many *evils* which too frequently *perplex* the imagination, and *hurt* the feelings of thoſe who occupy the higher ſtations of life. Of the many *vexatious* circumſtances ariſing from the *negligence*, the *petulance*, the *thefts*, and the long train of *vices* daily committed by *ſervants*, the *vulgar* can never form an *idea*, and, of courſe, cannot *feel* the *uneaſineſſes* which they occaſion. The *vulgar* are likewiſe exempted from a thouſand *reſtraints* and ceremonious *etiquettes*, which cramp the *freedom*, occupy fruitleſsly the *attention*, and give riſe to numberleſs *anxieties* and *diſappointments* among what are called *people of faſhion*. The *pleaſures* of the *vulgar*, though comparatively few, are more genuine and unadulterated, becauſe they are leſs *artificial*, and, of courſe, unaccompanied with *emulation* or *jealouſy*, and ſeldom followed with *regret* or mental *reproach*. The *pleaſures* of the *great* are generally tumultuary, exhauſt the ſpirits, and produce *languor* and *compunction*, two painful feelings which mutually augment each other.

Upon the whole, to men of obſervation and reflection, it muſt be apparent, that the laborious *pleaſures* of the *vulgar* are ſuperior to the *luxurious*, and, I may ſay, *painful pleaſures* of the *learned* and *opulent*.

Proceeding on our plan, we ſhall next conſider the condition of what are called *brute animals* with regard to *pleaſure* and *pain*.

Brutes are exempted from a thouſand ſources of *pain* which afflict even the *vulgar* of the human ſpecies. Brutes have not an idea of *futurity*; but they *enjoy* every moment of their exiſtence, which, though, in moſt of them, not ſo long protracted as that of man, is, in general, a continued ſeries of *pleaſures*. I ſpeak not of thoſe animals, or rather ſlaves, called *domeſtic;* for theſe, to the diſgrace of the human ſpecies, are too often overloaded, beat, ſtarved, and maltreated in a ſhocking manner; but I ſpeak of animals in that ſtate which the God of Nature formed them.

The abſence of *pain* is certainly a ſpecies of *pleaſure*. When nothing *hurts* either the *body* or the *mind*, *pleaſing* ſenſations muſt neceſſarily follow. The mere conſciouſneſs of exiſtence is *pleaſure*. If brute animals are excluded from the *pleaſures* of *imagination*, they are, at the ſame time, exempted from innumerable *tortures* to which it gives riſe. Many of them, wherever they ſtroll, find their natural food under their feet. Others, of a more rapacious kind, are obliged to hunt for their ſubſiſtence. Their food, of courſe, is more precarious. But Nature has endowed them with the faculty of ſuſtaining, with impunity, long abſtinence. She has likewiſe beſtowed upon them courage, artifice, patience, and alacrity both in attack and defence.

With regard to bodily *pain*, ariſing either from diſeaſe or external injury, the *brute* muſt ſuffer as much as the *man*. Brutes, however, though they *ſuffer* from theſe cauſes, are not *tormented*, like man, with the *terrors* of their conſequences. They have not a conception of *death*, far leſs of *future* exiſtence, and, what is infinitely worſe, of *eternal* and excruciating *torture*. But, to many of mankind, theſe are perpetual ſources of *miſery* and of *terror*.

Hitherto I have been talking of the comparative *pains* and *pleaſures* of the larger animals. I ſhall now hazard a few remarks with regard to the condition of the more minute tribes.

Inſects are animated beings as well as men and quadrupeds. But it is extremely difficult to form proper ideas of their pains or pleaſures. If we may judge, however, from the quickneſs and vivacity of all *winged* inſects, we ſhould reaſonably conclude that every inſtant of their exiſtence is attended with *pleaſure*. Their lives, eſpecially in their fly-ſtate, is ſhort; but, as a recompenſe, it is all *enjoyment*. They have their food, it is true, to ſearch for and procure; but, from the inſtruments which Nature has conferred upon them, they are enabled to extract nouriſhment from almoſt every vegetable and animal ſubſtance, and even from the earth and waters. In queſt of food, or of their proper mates, they are perpetually *active*; and *activity* itſelf is one of the principal ſources of *animal happineſs*. When *man*, whatever be the cauſe, loſes the ſprings of *activity*, from that moment he is *miſerable*. It is not unnatural, therefore, to conclude, that, whenever we ſee *activity* in the inferior animals, *happineſs* muſt be the conſequence.

The motions of thoſe *inſects* which are not furniſhed with wings are comparatively ſlow and languid; but we are not, from this circumſtance, warranted to infer that they are more *unhappy* than the winged tribes. Motion, whether quick or ſlow, requires *exertion*, and that exertion is not only *pleaſant*, but productive of vigour and of health. Still, however, when we conſult our own feelings, we are neceſſarily led to think, that the moſt *active* animals are the moſt *happy*. In the human ſpecies, an *active* mind *enjoys* life more completely than the *indolent* and *ſluggiſh*. *Sloth*, or the abſence of *activity*, is real *pain*. But ſlow motion, in ſome of the inſect tribes, does not imply *inactivity*; becauſe, from their frame, that ſlowneſs of movement requires, perhaps, even greater *exertions* than the rapid motions of other ſpecies.

The ſluggiſh motion of earth-worms, and of ſnails, may, to us, ſeem to indicate great *labour*, and even *pain*. But, it ſhould be conſidered, that, if their movements are comparatively ſlow, their travels are proportionably ſhort; for their food is almoſt perpetually before them.

The great multiplicity of inſects, both in ſpecies and individuals, is often attended with no ſmall injury to man as well as to many other animals. As a counterpoiſe, however, their enemies are innumerable. Myriads of birds, &c. daily devour ten thouſand times the number of *inſects*, both of the winged and reptile kinds. A bird, in an inſtant of time, ſwallows a fly; and, in the ſame inſtant, its life is extinguiſhed, without feeling, perhaps, a ſingle *pang*.

This ſubject ſhall be diſmiſſed with a few remarks. From the facts and obſervations related above, it ſeems to be apparent, that Nature, through the whole of her *animated* productions, has diſtributed her *pleaſures* and her *pains* in an equitable manner. If man and the larger animals are occaſionally ſubjected to a greater number of diſeaſes than the ſmaller tribes, their lives are, in general, protracted to a much longer ſpace; and, of courſe, the *quantity* of their *enjoyment* is increaſed. Some ſpecies of birds, as eagles, parrots, &c. beſide the *pleaſures* ariſing from their natural *activity*, are very long-lived. Moſt of the ſmall birds, though they live not ſo long, are ſtill more *active*; and, of conſequence, their *happineſs* is proportionably augmented. The

lives

lives of moſt inſects are very ſhort; but their *active enjoyments*, during their exiſtence, are almoſt perpetual. Thus, animals of every denomination appear to have nearly an equal portion of *happineſs* and of *pain* beſtowed upon them by the beneficent inſtitutions of Nature. Even *pain* itſelf is no inconſiderable cauſe of *pleaſure*; for, when abated or entirely removed, the *pleaſures* ariſing from theſe fortunate circumſtances are immenſe.

CHAPTER IX.

Of Poiſonous Animals.

POISON, it ought to be remarked, is a relative term. Subſtances which are deleterious or hurtful to one ſpecies of animals, afford the moſt ſalutary food to others. The bite of the common viper is very poiſonous, and its effects are various to man, as well as to many other animals. But broth made of vipers is often preſcribed by phyſicians in caſes of conſumption and of general weakneſs. I ſuppoſe, however, that the heads, which are the chief, or rather the only receptacles of the poiſon, are cut off before the animals are boiled; for FONTANA, that juſtly celebrated Naturaliſt, who made more experiments upon the nature and effects of poiſons than any man either before or after his time, has ſhown, that the venomous liquid, even when taken into the ſtomach, and without the intervention of any wound, is extremely dangerous and hurtful. REDI, and ſome other authors, maintain a contrary opinion. But FONTANA, with much probability, attributes theſe innocuous effects to the ſmallneſs of the quantities thrown into the ſtomach at one time.

The venom of all vipers, of which there are many ſpecies, when introduced, by means of a bite, into the bodies of men and other animals, is extremely hurtful, and, if not timely prevented, is certainly mortal. The Abbé FONTANA, anxious to diſcover a remedy to remove, or rather prevent, the dreadful effects of this animal poiſon, tried, often at the hazard of his own life, ſeveral thouſand experiments on this ſubject. In the courſe of theſe, he found, that oils, and particularly that of turpentine, were the moſt effectual in preventing the too often fatal effects of poiſoned wounds occaſioned by the bite of vipers. The beſt method of applying this remedy, he tells us from his own experience, which was great, is to foment the part affected with oil of turpentine as hot as the patient can conveniently bear, and to continue this application a long time. He thinks it alſo of uſe to keep the part affected immerſed in water, either pure or impregnated, with ſome of the neutral ſalts, or with quicklime. Theſe applications leſſen the pain and inflammation. He likewiſe found that vomits had ſome effect in preventing the danger, but cutting out the wounded part, as ſoon as poſſible after the accident, was always the moſt effectual remedy, becauſe it prevented the poiſon from being abſorbed into the general circulation of the maſs of blood, which infallibly produces death. The ſame method of care is practiſed with equal ſucceſs upon ſheep, horſes, and black cattle, who are much more liable, when browſing on heaths, to be wounded by vipers than the human ſpecies.

Upon this ſubject, a curious and extraordinary fact muſt not be omitted. That inſignificant and inactive inſect called the *freſh water polypus*, of all poiſonous animals, ſeems to poſſeſs the moſt powerful and active venom. Small water-worms, which the polypus is only able to attack, are ſo tenacious of life, that they may be cut to pieces without their ſeeming to receive any material injury, or to ſuffer much pain from the inciſions. But the poiſon of the polypus inſtantly extinguiſhes every principle of life and motion. What is ſingular, the mouth or lips of the polypus have no ſooner touched this worm than it expires. No wound, however, is to be perceived in the dead animal. By experiments made with the beſt microſcopes, it has been found, that the polypus is neither provided with teeth, nor any other inſtrument that could pierce the ſkin [*].

The *ſpider*, which feeds upon flies, waſps, and ſimilar inſects, is furniſhed with a very ſharp hooked forceps, placed near the mouth. With this weapon he ſeizes and pierces the fleſh of ſuch inſects as entangle themſelves in his web; and, at the ſame inſtant, by means of a ſmall white proboſcis, he infuſes a poiſonous juice into the wound, which, in a moment, kills the animal. This poiſon muſt be very active and deleterious; for flies, and many other inſects, may be mutilated by depriving them of their legs, wings, and even cutting their bodies through the very middle of the abdomen, and, in that condition, will ſurvive ſeveral days, as I have frequently experienced. I never proſecuted the experiment ſo far as to know whether any of the lopped off parts would be reproduced.

The poiſonous weapons of the *ſcolapendra*, or *centipes*, are ſomewhat different from thoſe of the ſpider. Its bite is ſo painful, eſpecially in the Eaſt Indies, as we are informed by BONTIUS, that it makes the patient almoſt mad. When the claws of its forceps are examined by a microſcope, on the upper ſide of each of them, near the point, a ſmall aperture appears, through which the venom is conveyed into the wound. Of the Eaſt India centipes, LEEUWENHOEK [†] had one ſent to him alive; and he found, that, by preſſing the claw, a ſmall drop of liquor iſſued out of this aperture.

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[*] Abbé Fontana on Poiſons, vol. 1. p. 106. Tranſ.

[†] Continuatio Arcan. Natur. epiſt. 124.

Stinging animals, of which the *ſcorpion* is the chief, likewiſe inſtil a liquor into the wounds they make. The poiſon of ſcorpions is more or leſs virulent in proportion to the heat of the countries they inhabit. In ſome parts of Africa, its effects are ſo dreadful, and theſe horrible reptiles ſo numerous, that LEO tells us, the town of Peſcara is annually almoſt totally deſerted by the inhabitants in the ſummer months; becauſe inevitable death is the conſequence of the ſcorpion's ſting *. Signor REDI, when reſiding at Florence, had ſeveral African ſcorpions ſent him from Tunis. They arrived in the month of November; and he irritated them to ſting pigeons, pullets, &c. without diſcovering the ſmalleſt ſymptoms of uneaſineſs in theſe animals. But, what is ſingular, on the approach of ſpring, one of the ſcorpions, which had remained no leſs than eight months without food, and the wound of whoſe ſting was formerly attended with no bad effects, ſtung to death two pigeons ſucceſſively. A third and fourth, however, though wounded in the ſame manner, received no injury. But the ſame ſcorpion, after being allowed to reſt all night, killed another pigeon next morning. At the point of the ſting, REDI often obſerved a ſmall drop of white liquor, which entered the animal's body along with the ſting. This liquid venom, it ſhould appear, is not ſecreted from the blood and other juices of the animal, during the cold months of winter. The operation of cold is alſo greatly aſſiſted by abſtinence from food. Benumbed with cold, and half-ſtarved for want of food, how is it to be expected that the animal's fluids ſhould retain their former vigour and activity, far leſs that they ſhould be able to afford a liquor ſo highly exalted as to deprive other creatures of life? Like certain fluids of other animals, which are ſecreted in ſmall quantities only, the ſting of the ſcorpion, even in the hotteſt months of ſummer, after two or three attacks, is perfectly inoffenſive, till the expenditure of this deleterious liquor has again been replaced by the operation of food and of time.

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* Leo Hiſtor. Afric. lib. vi.

In the hiſtory of the *ſcorpion*, a remarkable circumſtance muſt not be omitted. We are informed by gentlemen of veracity, who had lived ſeveral years in *Barbary*, that, when a ſcorpion is ſurrounded with a circle of burning coals or wood, and the animal begins to be pained with the heat, it runs about violently in queſt of ſome mode of eſcape; but, finding that impoſſible, it ſtrikes itſelf two or three times on the back parts with its ſting, by which wounds its life is immediately extinguiſhed. We are likewiſe told, that this is a common amuſement among the ſoldiers of Gibraltar, where theſe noxious animals abound. This ſelf-murder, produced by pain and deſpair, indicates two curious inſtincts; 1. That the ſcorpion is ſenſible of his dangerous ſituation; and, 2. That he knows the mode of getting quit of a painful and deſperate exiſtence. This fact likewiſe decides another controverſy, whether poiſonous animals of the ſame ſpecies can kill another by an infuſion of their venom. The ſame fact is exhibited by the viper. Dr HERMAN, when tranſporting three large vipers in one glaſs, two of them were killed during the voyage by fighting and biting each other with their poiſonous fangs; and the learned RHODIUS obſerved, at Padua, that two ſcorpions, which were put into the ſame glaſs, fought with their ſtings, and one of them firſt killed the other, and then devoured it.

The ſtructure of the ſtings of *bees*, *waſps*, *hornets*, &c. has been accurately deſcribed by ſeveral authors, and particularly by **Hooke** and **Reaumur**. Even with the naked eye, a perſon may ſometimes perceive a bee diſcharge the venom from its ſting; which is rendered ſtill more perſpicuous by a common magnifying glaſs. As the ſtings of theſe, and many other ſmaller inſects, often produce inflammation and pain, theſe effects may be very ſoon prevented or removed by ſucking out the inſtilled poiſonous drop with the mouth; but, if this has been neglected, fomenting the part affected with warm oil and diſcutient ointments, as in the bite of the viper, ſeldom fails to be a complete cure.

We ſhall now make a few remarks upon the bite of that enormous ſpecies of ſpider denominated the *tarantula*. It is very frequent in, and infeſts that warm diſtrict of Italy called *Apulia*. **Baglivi**, a native of that country, and a well known and learned phyſician, publiſhed a long diſſertation on this ſubject [*]. After **Baglivi**, **Ludovicus Valetta**, a Celeſtine monk of Apulia, favoured the world with a treatiſe concerning this dangerous ſpider [†].

The *tarantula* is a ſpider of that ſpecies which has eight eyes and eight legs, four on each ſide, and three joints in every leg. From the mouth proceed two ſharp darts ſimilar to a hooked forceps, or the claws of a crab, by which the animal can eaſily pierce the ſkin; and, after the wound is inflicted, the tarantula, by means of a proboſcis ſituated between the claws of the forceps, inſtils a drop of a moſt active venom, which reſiſts the operation of the uſual *alexipharmic* medicines; for, notwithſtanding the repeated uſe of them, the patient is affected with a gradually increaſing melancholy, grows perfectly ſtupid and timorous, and, in a ſhort time, expires. By what accident or fortunate thought an almoſt certain cure for the bite of the tarantula was firſt diſcovered, it is of little moment to inquire. But it is an unqueſtionable fact, that *muſic* is the only effectual remedy. At the firſt ſound of a muſical inſtrument, if the tune happens to rouſe the attention and ſtrike the fancy of the patients, though lying motionleſs, as in a fit of apoplectic ſtupor, they gradually begin to move their hands and feet, and at laſt get up, and, for three or four hours, dance with wonderful vigour and agility, which occaſions profuſe ſweatings. They are then put to bed for a ſhort time, and afterwards renew their dancing with the ſame ſpirit and vehemence. Inſtead of being exhauſted by this violent exerciſe, the patients declare, and ſhow by their exertions, that, inſtead of fatiguing them, the more they dance they become the ſtronger and the more nimble. In this exerciſe, the perſons bit by the tarantula generally occupy twelve hours a day, and continue it for three or four days, when all ſymptoms of diſtreſs are completely removed. It is not every ſpecies of muſic which excites patients; for ſome are ſtruck with one kind, and ſome with another. One is rouſed with a flute, another with a timbrel; one with a harp, and another with the violin. The muſicians, accordingly, are obliged to make a variety of trials before they can accommodate their art to the minds of the ſufferers. But we are aſſured by REDI, MEAD, FONTANA, &c. that briſk and chearful tunes produce the moſt inſtantaneous and happy effects; but that ſlow and melancholy airs have not the ſmalleſt influence. Whilſt the *tarantali*, as they are called, or perſons who have been bit by the tarantula, are dancing to muſic, they ſeem to loſe all ſenſe of modeſty and decorum; they perform many ridiculous tricks, and talk in the moſt obſcene manner. Heat exalts, and, of courſe, augments the dangers ariſing from every ſpecies of animal-poiſon. Apulia is the hotteſt diſtrict of Italy; and, accordingly, the bite of the tarantula there produces more violent effects than in any other part of that country. The inhabitants of Apulia, from the heat of the climate, conjoined, perhaps, with ſome other circumſtances, are generally meagre, paſſionate, witty, and, in an uncommon degree, ſubject to inflammatory diſeaſes, phrenſies, melancholy, and other ſpecies of madneſs. We are informed by Dr MEAD, who collected his facts from the moſt reſpectable authorities, that, in other countries, cauſes which produce only a ſlight melancholy, occaſion the moſt deplorable effects in Apulia. 'Women,' he remarks, 'in a *chloroſis*, ſuffer almoſt 'the ſame ſymptoms as perſons poiſoned by the tarantula do, and 'are cured the ſame way; and, in like manner, the venom of the 'ſcorpion does here, in effects and cure, agree very much with that 'of this ſpider *.'

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[*] See Baglivi de Praxi Medica, et Diſſertationes, Romae, 1696.

[†] De Phalangio Apulo Opuſculum, Neapoli, 1706.

From theſe, and many other inſtances of ſalutary effects of *muſic* in removing diſeaſes produced by animal-poiſons, it is amazing that this remedy is ſo ſeldom tried by our modern phyſicians. In many ſpecies of melancholy and madneſs, from whatever cauſes they originate, the effects of different kinds of muſic might at leaſt be tried. If a perſon labouring under a deep melancholy could be excited to dance with ſpirit, and even with ſome violence, profuſe ſweats would be induced, and, probably, as in caſes of mania occaſioned by the bites or ſtings of poiſonous animals, theſe ſweats would expel the noxious cauſe from the ſyſtem. Muſic might even be tried in the paroxyſms of madneſs. If it ſhould be found, which is by no means improbable, that muſic allays or cools the over-heated animal fluids, and, conſequently, the turbulence of the mind, this cure would be infinitely more humane than the *coercions* of *ſtrait waiſtcoats*, *ſtripes*, &c. which are, perhaps, too commonly preſcribed even by the beſt phyſicians.

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* Mead on Poiſons, p. 108.

Ideas of this kind ſhould not be deſpiſed. The antients, with great wiſdom and ingenuity, employed *muſic* as a cure, or, at leaſt, as an alleviating remedy in almoſt every kind of *madneſs*. We are informed by a Jewiſh hiſtorian *, that SAUL, then King of the Jews, was afflicted with an *evil ſpirit* ſent from the LORD; that is, the man was *mad*. What I think exceedingly curious, and ſhows the general opinion among thoſe people concerning the ſalutary effects of *muſic* in mental diſeaſes, is, that even the *ſervants* of SAUL, when he was frantic, recommended *tunes* on the *harp* as the moſt effectual cure. The paſſage is ſo remarkable, that I cannot refrain from tranſcribing it. 'And SAUL's ſervants ſaid unto him, Behold now 'an evil ſpirit from GOD troubleth thee: Let our lord now command thy ſervants, which are before thee, to ſeek out a man who 'is a *cunning player* on an *harp*: And it ſhall come to paſs, when 'the evil ſpirit from GOD is upon thee, that he ſhall play with his 'hand, and thou ſhalt be well. And SAUL anſwered one of his ſervants, and ſaid, Behold, I have ſeen a ſon of JESSE the Bethlehemite, that is *cunning* in *playing*.—Wherefore SAUL ſent meſſengers 'unto JESSE, and ſaid, Send me DAVID thy ſon, which is with the 'ſheep. And JESSE took an aſs laden with bread, and a bottle of 'wine, and a kid, and ſent them by DAVID his ſon unto SAUL. 'And DAVID came to SAUL, and ſtood before him; and he loved 'him greatly, and he became his armour-bearer. And SAUL ſent to 'JESSE, ſaying, Let DAVID, I pray thee, ſtand before me; for he 'hath found favour in my ſight. And it came to paſs, when the

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* 1. Samuel, chap. 16.

'evil ſpirit from GOD was upon SAUL, that DAVID took an *harp*, and 'played with his hand: So SAUL was *refreſhed*, and was *well*, and 'the evil ſpirit departed from him *.' This is all well; but, from the following part of the hiſtory, we learn that DAVID was not only *cunning* in playing on the *harp*, but that he was equally *cunning* in *politics;* for, in a ſhort time afterwards, he *harped* poor SAUL both out of his *kingdom* and his *life*.

The old Greeks and Romans ſeem to have underſtood the effects of *muſic* in alleviating and even curing particular diſeaſes. We are told by GALEN, an antient, and, to this day, a moſt celebrated phyſician, 'that ÆSCULAPIUS uſed to recover thoſe, in whom violent 'motions of the mind had induced a hot temperament of body, by 'melody and ſongs †.' PINDAR, in one of his odes, takes notice of the ſame happy effects produced by *muſic*; and Dr MEAD very properly remarks, that, from theſe and ſimilar facts, not only the notion but the term of *charming (a carmine)* ſeems to have derived its origin ‡. THEOPHRASTUS, in his Treatiſe on *Enthuſiaſm*, informs us, that *iſchiadic* pains were cured by the *Phrygian* melody. This ſpecies of muſic was performed upon the pipe, and was the moſt vehement and exhilarating that was known among the antients; for it ſometimes excited the hearers to what had the appearance of maniacal and furious exertions of body ‖, which perfectly correſponds with the effects of *muſic* in expelling the venom of the *tarantula*. Beſide the effects of muſic upon the minds of perſons labouring under certain diſeaſes, ſome of the antient phyſicians carried this practice

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[*] 1 Samuel, chap. 16. verſe 15. to the end.

[†] De Sanit. Tuenda, lib. 1. cap. 8.

[‡] Mead on Poiſons, p. 123.

[‖] Bartholin. de tibiis veter. l. 1. c. 9.

tice farther, and placed the inſtrument upon the part affected. CAELIUS AURELIANUS denominates this application of muſic, *decantare loca dolentia;* and adds, that the pain is mitigated and often diſcuſſed by the tremblings and palpitations of the diſeaſed part *. AULUS GELLIUS mentions this ſame cure of *iſchiadic* complaints, and ſubjoins, from THEOPHRASTUS, 'that the muſic of a pipe, rightly 'managed, healed the bites of vipers †.'

APOLLONIUS tells us, that *muſic* cured diſtractions of mind, epilepſies, and many other diſtempers ‡. As to this fact, he is joined by DEMOCRITUS, who taught, that the *muſic* of *pipes* was the proper medicine for many diſeaſes ‖; which THALES of *Crete* confirmed by his practice. When ſent for by the LACEDEMONIANS to remove the peſtilence from them, he is ſaid to have done it by the operation of *muſic* §. All theſe inſtances ſhow, at leaſt, that *muſic* was very antiently employed as a remedy both in mental as well as corporeal diſeaſes. CAELIUS AURELIANUS aſcribes the invention of this cure to PYTHAGORAS, who ſettled and founded his ſect in that very part of Italy where the *tarantulae* are moſt frequent, which was then called *Graecia Magna*, and now *Calabria*.

With regard to the dreadful effects produced by the bite of a *mad dog*, we ſhall make only a few remarks. The terrible diſeaſe it occaſions is generally known by the appellation of *hydrophobia*, or *dread of water*. The wound from the bite of a mad dog, at firſt, differs

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* Morb. chronic. lib. 5. cap. 1.

† Noct. Attic. lib. 4. cap. 13.

‡ Hiſtor. Mirabil.

‖ Apud Aul. Gell. loc. citat.

§ Plutarch. de Muſica.

not from that of any other animal, and heals as ſoon; for a conſiderable time often elapſes before any ſymptoms of madneſs appear. Inſtances are recorded where the diſeaſe was deferred till two, three, or ſix months after the wound was inflicted. I myſelf knew a caſe where the wound did not ſhow itſelf till full twelve months after the bite. This caſe was that of JAMES POLLOCK, a blackſmith and athletic perſon, in the ſuburbs of Edinburgh. As ſoon as ſymptoms of madneſs appeared, he was carried to the Royal Infirmary, where, in a few days, he died of an evident *hydrophobia*. GALEN tells us, that he ſaw a caſe of *hydrophobia* more than a year after the wound was received *. Dr MEAD, who had great practice as well as ſkill with regard to the effects of different poiſons, informs us, that he knew a caſe of this diſeaſe more than eleven months after the fatal accident. He adds, however, that the attack generally happens in thirty or forty days, and ſometimes, eſpecially in young people, in fifteen or ſixteen. The firſt approaches of this diſtemper are commonly diſcoverable by an acute pain in the part that had been wounded, which gradually extends to the adjacent parts, and is followed by a general laſſitude, and an uneaſineſs in the limbs. The patient then grows melancholy; his ſleep is diſturbed and unrefreſhing; he complains of faintneſs and of depreſſed ſpirits, and eſpecially of an oppreſſion at his breaſt; his pulſe intermits; his nerves and members tremble; he is affected with cold ſweats, a great ſickneſs, and loaths every ſpecies of food. Though he feels an inward heat and thirſt, and wiſhes to drink; yet he ſwallows meat, but particularly liquors, with the utmoſt difficulty. These ſymptoms proceed increaſing in their violence; and, the next day, from the pain he feels in ſwallowing, he conceives ſuch an averſion to liquids, that the very ſight of them throws him into dreadful convulſions. This *hydrophobia* has always been conſidered as an infallible ſymptom of a perſon's being affected by the poiſon proceeding from the bite of a mad dog; for it ſeldom, if ever, appears in any other diſeaſe.

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* Comment. 2. in 1. Prorrhet. Hippocrat.

At this period of the diſtemper, a fever uſually comes on, which is attended with a quick but low pulſe. The patient cannot command the ſmalleſt degree of ſleep; his voice turns hoarſe; a white froth collects in his mouth, which he ſpits out upon the people about him; univerſal convulſions ſucceed, but particularly in the throat, and in the *muſculi erectores penis*, which produce a continued *priapiſm*. During this diſmal ſcene, which is generally fatal in the courſe of two or three days, a *delirium* appears, ſometimes attended with the moſt dreadful paroxyſms of rage and fury, and frequent attempts of the patients to injure their moſt beloved friends and relations. But this diſeaſe, inſtead of *furor*, more commonly terminates in a deep *melancholy*. In this ſituation, the unhappy but humane patient, reſigns himſelf to the quick approaches of death, and deſires his attendants to beware leſt he ſhould hurt them, begs them not to trouble him any more, and, in a ſhort time, expires in convulſions.

This cruel and terrifying diſeaſe is taken notice of by many of the antients, ſuch as DIOSCORIDES, GALEN, AETIUS, ÆGINETA, &c. None of them, however, have deſcribed it ſo accurately, and with ſo much preciſion, as CAELIUS AURELIANUS *. From the writings of SORANUS, and other Greek phyſicians, he has collected the ſymptoms of this diſeaſe with great care and exactneſs. Among the moderns, the hiſtory of this malady is ably delivered to us by VANDER WIEL †, and the ingenious Dr LISTER ‡. There are ſome ſymptoms,

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* De Morbis acutis, lib. 3.

† Obſervat. varior. cent. 1. obſ. 100.

‡ Exercit. Medicinal.

toms, though with occaſional variations, are common to all perſons infected with this deleterious poiſon. The ſlighteſt touch of any part of their bodies is painful. The ſmalleſt noiſe is offenſive to their ears; and the opening or ſhutting of a door terrifies them as much as if the houſe were falling upon them. Light is ſo hurtful to the eyes, that even the ſight of any white ſubſtance becomes intolerable. The internal parts are likewiſe ſo tender and eaſily affected, that they cannot bear their natural *ſtimuli*. The ordinary coolneſs of freſh air is diſagreeable to the lungs; and the paſſage of urine is accompanied with great pain. The aſpect of the ſufferers is either frightful with threatening ſymptoms of rage and fury, or dull, depreſſed, and attended with moanings and every indication of deſpair. When the patient is *maniacal*, the ſtrength of the muſcles is almoſt incredible. Dr MEAD mentions a caſe of a man who was tied down in bed with ſtrong cords; but ſuch was the convulſive force of his muſcles, that he broke the whole by one great exertion, and immediately died paralytic. But ſuch exertions of ſtrength are not peculiar to *canine* madneſs. In every ſpecies of *mania*, from whatever cauſe it originates, when an actual *furor* comes on, the exertions of muſcular force are prodigious. The cauſe of this increaſed force of muſcular action is obvious. In madneſs, the ſenſe of pain is either almoſt extinguiſhed, or, which amounts to the ſame thing, is not attended to by the patient. Whenever the ſenſe of pain is blunted or obliterated, nothing but actual tearing the tendons or muſcular fibres can put an end to their mechanical powers. Men, when not diſordered in mind, are obliged to deſiſt from overſtretching their muſcles by the pain it produces.

With regard to the *cure* of this horrible diſtemper, it accords not with my plan to be very particular. When evident ſymptoms of canine

nine madneſs once exhibit themſelves, the ſkill of the phyſician, as well as the virtues of medicines, are totally ineffectual. But, whenever a perſon is bit by a dog who is, perhaps, only ſuppoſed to be mad, medical practitioners, with great propriety, employ preventative remedies, the principal of which I ſhall juſt mention.

The wounded part is the firſt object of attention. The antient phyſicians *, who, in this article, are ſtill followed by the moderns †, adviſed, where the part would admit of it, that the wound ſhould be enlarged by inciſion; that a cupping-glaſs ſhould be applied; that the wound ſhould be ſeared with a hot iron; and that a diſcharge from the ulcer ſhould be artificially kept up for many days. Two or three preventative remedies are recommended upon ſeemingly rational grounds: The *cineres cancrorum fluviatilium*, or aſhes of the river craw-fiſh, have been often celebrated. Theſe were procured by burning the fiſh alive upon a plate of copper, with a fire made of the twigs of white briony. GALEN avers, that this remedy was never employed without ſucceſs. Before the days of GALEN, DIOSCORIDES tells us ‡, that this plant is a medicine, the efficacy of which may be relied upon. A ſpoonful or two of this calcined powder were given to the patient every day; and the ſame doſe was continued for forty days. It was uſed either alone, or mixed with a ſmall porportion of *gentian root* and *frankincenſe*.

The *Spongia, vel Cynorrhodi, Roſae ſylveſtris*, the ſponge of the dog-roſe, is another celebrated antidote againſt canine as well as other animal poiſons. P. BACCONE ‖, who wrote a treatiſe upon its

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[*] Galen. de Ther. ad Priſ. lib. 1. cap. 16. Aetius, lib. 6. cap. 14. Celſus, lib. 5. cap. 27.

[†] Hildan. Obſ cent. 1. obſ. 87.

[‡] De Theriac. cap. 2.

[‖] Muſco de plante rare, obſ. 2.

its virtues, informs us, that, in Sicily, it has received the denomination of *Sanatodos*, or *All-heal.* The plant *Alyſſum*, or *Madwort*, among the antients, had its name from its great efficacy in preventing *canine madneſs.* *Garlic*, *Agrimony*, and *Oxylapathum*, were likewiſe employed with advantage. Dr **Mead** juſtly remarks, that all theſe remedies are powerful *diuretics.*

Moſt *inſects*, eſpecially when taken internally, create an unuſual diſcharge of *urine:* But thoſe flies, known by the name of *Cantharides*, have a more powerful effect in promoting this evacuation than any other ſpecies. The learned **Baccius** [*], from the authority of **Rhazes** and **Joannes Damascenus**, preſcribes *Cantharides* to be given in ſubſtance for many days ſucceſſively. This *antidote*, as he calls it, is prepared by infuſing the flies in ſour butter-milk twenty-four hours, then drying them, and, with the flour of lentils and wine, making them up into troches of about a ſcruple in weight, one of which is to be taken every day. Even though the patient, he adds, by the uſe of this medicine, ſhould paſs urine mixed with blood, yet copious draughts of milk removes that ſymptom, and the *hydrophobia* is happily prevented. We are likewiſe informed by **Baccone**, that the phyſicians in Upper Hungary preſcribe five *Cantharides* as a doſe to men, and a greater quantity to larger animals [†].

Aetius [‡], who carefully collected all the medicines preſcribed by the antient phyſicians for preventing or curing *canine* madneſs, affirms, that he himſelf knew an old man who cured thoſe who had the misfortune to be bit with *common ſorrel* only. He waſhed the wound with a decoction of this plant, and laid it on the part as a cataplaſm, and likewiſe gave it in drink, which made the patient diſcharge great quantities of turbid urine.

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[*] De Venen. p. 89.

[†] Muſeo di fiſica, obſ. 21.

[‡] Lib. 6. cap. 24.

From all theſe and ſimilar accounts, it appears that the remedies againſt the effects of this poiſon have, in all ages, been ſtrong *diuretics*. By reflecting on this circumſtance, the celebrated Dr MEAD was led to recommend the following preſcription: 'Let the patient 'be blooded at the arm nine or ten ounces. Take of the herb called, in Latin, *Lichen cinereus terreſtris*; in Engliſh, *Aſh-coloured 'ground liver-wort*, cleaned, dried, and powdered, half an ounce;— 'of black pepper powdered, two drachms: Mix them well together, 'and divide the powder into four doſes, one of which muſt be taken 'every morning, faſting for four mornings ſucceſſively, in half a pint 'of cow's milk warm. After theſe four doſes are taken, the patient 'muſt go into the cold bath, or a cold ſpring or river, every morning faſting, for a month: He muſt be dipped all over, but ſtay in '(with his head above water) longer than half a minute, if the water 'be very cold. After this, he muſt go in three times a week for a 'fortnight longer *.'

This remedy was firſt publiſhed in the Philoſophical Tranſactions of London †, by Mr DAMPIER, in whoſe family it had been long, and, of courſe, infamouſly kept a ſecret. In the year 1721, however, Dr MEAD, like a gentleman and a man of humanity, procured it to be inſerted in the *Pharmacopeia Londinenſis*, under the name of *Pulvis antilyſſus*. This Lichen, like the other medicines formerly recommended, is a ſtrong diuretic. To this preſcription Dr MEAD added cold bathing, either in the ſea or river water, according to the ſituation

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* Mead on Poiſons, p. 164.

† No. 237.

tion and circumſtances of the patient. The antients alſo had the idea of curing canine madneſs by cold bathing. But, inſtead of employing it as a preventative, they never uſed it till evident ſymptoms of *hydrophobia* appeared, when it was perfectly ineffectual. Beſides, their practice often amounted nearly to actual *drowning*, which, to be ſure, would remove every diſeaſe as well as the *hydrophobia*. Celsus [*], who was a bold as well as a ſkilful phyſician, preſcribes cold bathing as the only certain cure for this dreadful diſeaſe; and adviſes, that, if the patient cannot ſwim, he ſhould be allowed to remain ſome time under the water, that he may ſwallow part of the fluid; and, if he can ſwim, that he ſhould be kept under by force, in order to compel him to drink. Dr Mead remarks, that this practice is juſt *drowning* and *recovering* by turns [†]. We are told by the famous Van Helmont [‡], that he ſaw an old man, who had been ſeized with the *hydrophobia*, cured by *ſubmerſion* in ſalt water; that this patient was firſt held under water about four minutes, then taken out, and again plunged twice, about a minute each time; that, when taken out, he was thought to be quite *dead*; but that, by warmth, and by being laid acroſs a barrel, he threw up the water he had been obliged to ſwallow, and recovered both his life and right ſenſes! The ſame author tells a ſtory of a cure of the common *mania* by *drowning* the patient in freſh water; from which he draws this *ſage* concluſion, that it makes no *difference* in the caſe whether the water be *ſalt* or *freſh*! Such medical practice may be reckoned *bold*, as it certainly is; for, to *drown* any perſon will moſt effectually remove all his *complaints*! It is aſtoniſhing that the learned Dr Mead, within leſs than fifty years ago, ſhould have related ſeriouſly ſtories almoſt equally ridiculous in *ſubſtance*,

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[*] Lib. 5. cap. 27.

[†] Mead on Poiſons, p. 172.

[‡] Ortus Medicin. demens idea.

as they are abſurd in the *terms* he employs; but ſo it is*! The Doctor, however, afterwards remarks, that, before the canine madneſs makes its appearance, ſimple *immerſion*, without *drowning*, often prevents this horrible diſeaſe †.

Two other preventative remedies have been, by ſome phyſicians, highly recommended. 1. What is called the *Ormſkirk medicine for the bite of a mad dog*: It is no part of my buſineſs to give ſpecific quantities, becauſe theſe may be either falſe or fanciful. I ſhall, however, relate the baſes of the two ſuppoſed remedies.

1. The *Ormſkirk* medicine conſiſts of chalk, alum, Armenian bole, the powder of the plant called *elacampen*, and the oil of aniſeſeeds.

2. The *tonquin* remedy, which is recommended as an antidote by Sir GEORGE COBB. It is compoſed of native and factitious cinnabar, compounded with muſk.

With regard to the *ſerpent* tribe, which is very numerous, ſome of them are armed with *fangs*, through which a mortal poiſon is conveyed into the bodies of ſuch animals as they happen to bite; but luckily the proportion of theſe noxious ſpecies, when compared to the whole, is very ſmall. The ſpecies of *ſerpents* deſcribed by LINNÆUS amount to 218, of which 32 only are poiſonous, and, of courſe, 186 are innocuous. Of *lizards*, 77 ſpecies are enumerated, not one of which contains or emits a particle of venom. The *toad* is a verrucous animal, has a lurid appearance; his movements are ſluggiſh and diſguſting; and, when irritated, he emits, from every pore of his body, a frothy ſubſtance like ſaliva. The forbidding aſpect of the toad has created him numberleſs enemies, as well as a very bad, though very unjuſt, character. Wherever he appears, he is perſecuted, maltreated, and murdered, by children, and even by adults, on the ſuppoſition, that, becauſe he is an ugly animal, he muſt therefore be venomous; but, notwithſtanding his unſeemly appearance, he is inoffenſive, and perfectly deſtitute of poiſon. The ſame remark applies both to our water and land *lizards*, of which we have very few ſpecies that are natives of Britain. Still, however, though their aſpect is by no means ſo diſguſting as that of the toad, a ridiculous opinion is generally entertained that they are venomous, and they, accordingly, ſuffer the ſame perſecution as that innocent animal.

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* Mead on Poiſons, p. 173.

† Ibid. p. 177.

Of venomous animals, I have looked, but looked in vain, for a final cauſe. What could be the intention of creating *reptiles*, both abhorrent to the ſight, and, by their bites or ſtings, fatal to men and other animals, I cannot even form a conjecture. Their poiſon, it has been ſaid, is given to them as a perſonal protection. That I deny; for, even of the *ſerpent* tribes, though the form of their bodies, and their mode of life be nearly the ſame, not one in ten of them are provided with this ſuppoſed defence. A man, when walking, either for health or amuſement, on a graſſy turf, accidentally tramples upon a viper; the abominable reptile bites him, inſtils a poiſon into the wound, and, if proper remedies are not timely applied, a cruel and inevitable death is the conſequence. He will be more than an intelligent man who can demonſtrate a *final*, or, which is the ſame thing, a *good* cauſe, for ſuch a *conſequence*. Serpents have, in all ages and countries, had the reputation of extraordinary *ſagacity*, or rather *cunning*, for what reaſon I could never diſcover. Their aſpect, their movements, the idea of their venom, in a word, their whole frame, excite horror. When theſe circumſtances are taken into conſideration, what, in the name of wonder, ſhould have induced MOSES to repreſent this *vile*, this *abhorrent* animal, as a proper object of *temptation* to what, we muſt ſuppoſe, to have been the fineſt woman that ever exiſted? Yet *ſuch things are!*

Concluſion of the PHILOSOPHY OF NATURAL HISTORY.

I HAVE now finiſhed my original plan; with what ſucceſs I know not. I ſhall only ſay, what every intelligent reader will eaſily perceive, that my labours have been great. Before I began the work, had I known the numerous authors which it was neceſſary to peruſe and conſult, I ſhould probably have ſhrunk back, and given up the attempt as impracticable, eſpecially for a man ſo early engaged in the buſineſs of life, and the cares reſulting from a family of no leſs than *thirteen* children, *nine* of whom are ſtill in life.

In the firſt and ſecond volumes, I have endeavoured to unfold the general as well as diſtinctive properties of the vegetable and animal kingdoms. Occaſionally, I have done more. I have ſometimes given pretty full characters both of the figure, diſpoſitions, and manners of animals. In theſe deſcriptive diſcurſions, MAN has not been neglected. Being the principal animal in this planet, he, of courſe, deſerved particular attention, and it has not been with-held.

with-held. The varieties of the human ſpecies, in every region of the globe, have been collected and deſcribed from the moſt authentic reſources both antient and modern. Even in the moſt uncultivated, and, to us, deplorable ſituation of the human race, evident traces of goodneſs, of genius, and of heroiſm, are to be found. Theſe amiable qualities, it muſt be confeſſed, are too often ſullied by cruelty, iraſcible paſſions, and every ſpecies of vice. But theſe qualities are univerſal, in whatever ſituation men, whether in a civilized or barbarous ſtate, are placed. The ſtrangeſt and moſt unaccountable part of the hiſtory of mankind is that of their *eating* one another; and yet, from the numerous evidences I have produced, it is impoſſible not to give credit to the ſhocking fact. The reality of ***human ſacrifices*** is equally certain as the exiſtence of *cannibals*. The diverſity of diſpoſitions, the verſatility of genius, the great differences of taſte and of purſuits, are ſtrong characters of *Man*, and diſtinguiſh him eminently from all the other inhabitants of this earth.

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Caffres. See Hottentots.

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Calicut, Naires, or nobles of, whoſe ſole profeſſion is arms;—handſome and comely;—of an olive colour;—tall, hardy, brave, and dexterous;—lengthen their ears to their ſhoulders;—have each only one wife;—but the wives have as many huſbands as they chooſe;—this privilege confined to ladies of rank among them, 188. Common people ſmaller and worſe ſhaped than the nobles; thick legged, ibid.

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FINIS.